# ELECTRICAL REVIEW

FRIDAY
10 FEBRUARY 1961

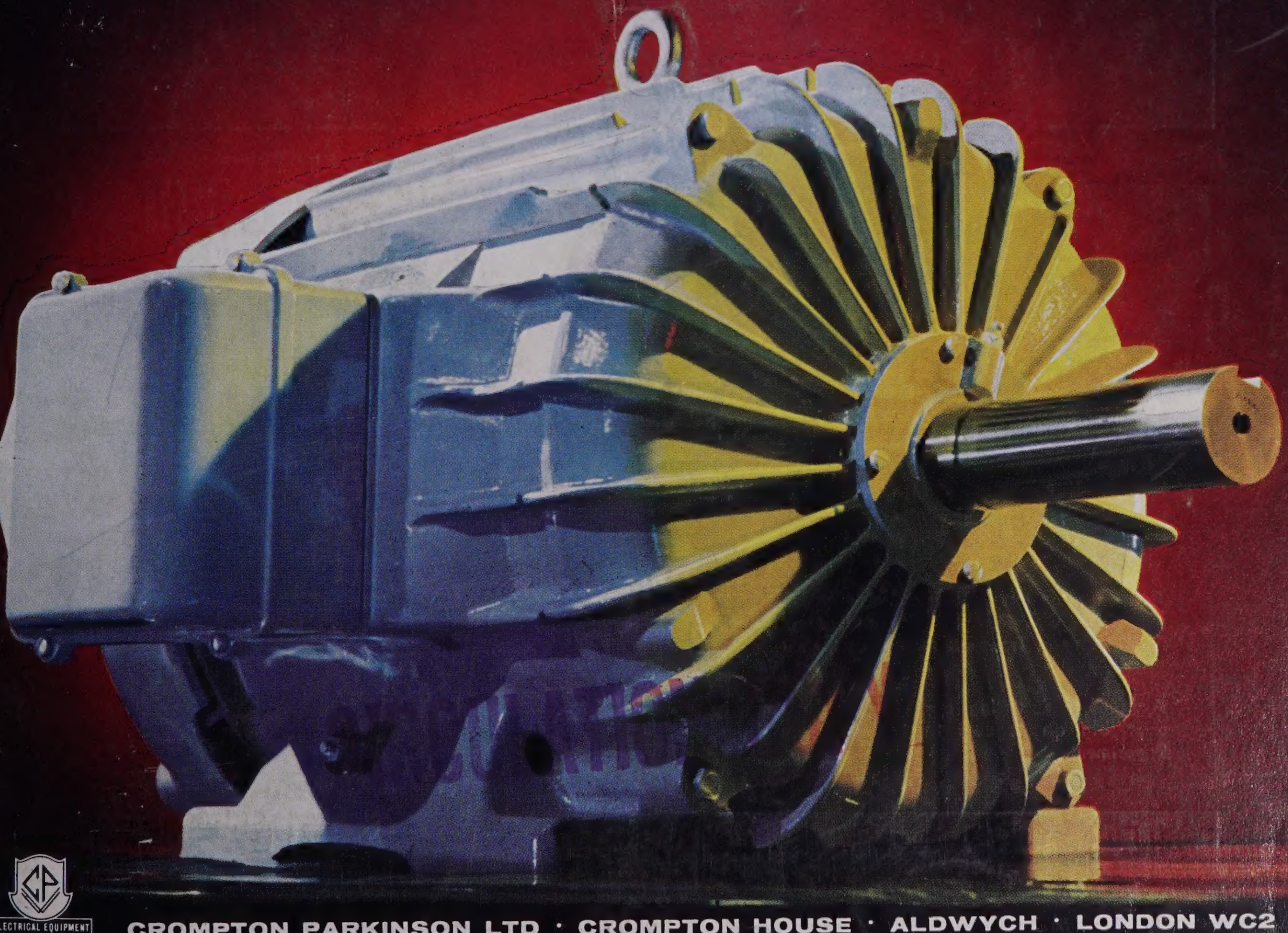
WEEKLY
PRICE 1s 6d

RECEIVED
1961

THE NEW COMPLETE RANGE OF 'KD' MOTORS BY **Crompton Parkinson**

MAKES MOTORS BUILT TO B.S. 2083 OBSOLETE FOR NEW APPLICATIONS

Amendment No. 2, of 2nd November 1960 to BS 2083 means just that—the new 'KD' motors being built to B.S. 2960: Part 2: 1960.



ELECTRICAL EQUIPMENT

CROMPTON PARKINSON LTD · CROMPTON HOUSE · ALDWYCH · LONDON WC2

**STANTON**

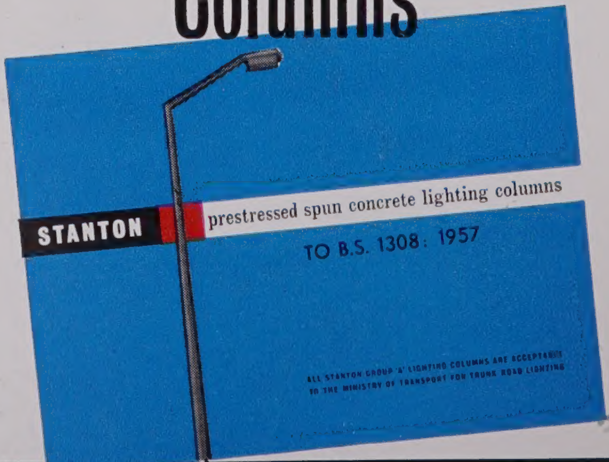
# Prestressed Spun Concrete Lighting Columns

Stanton Type 8F Spun Concrete Lighting Columns at Swanwick, Derbyshire, fitted with Atlas Alpha 1 Sodium Lanterns.

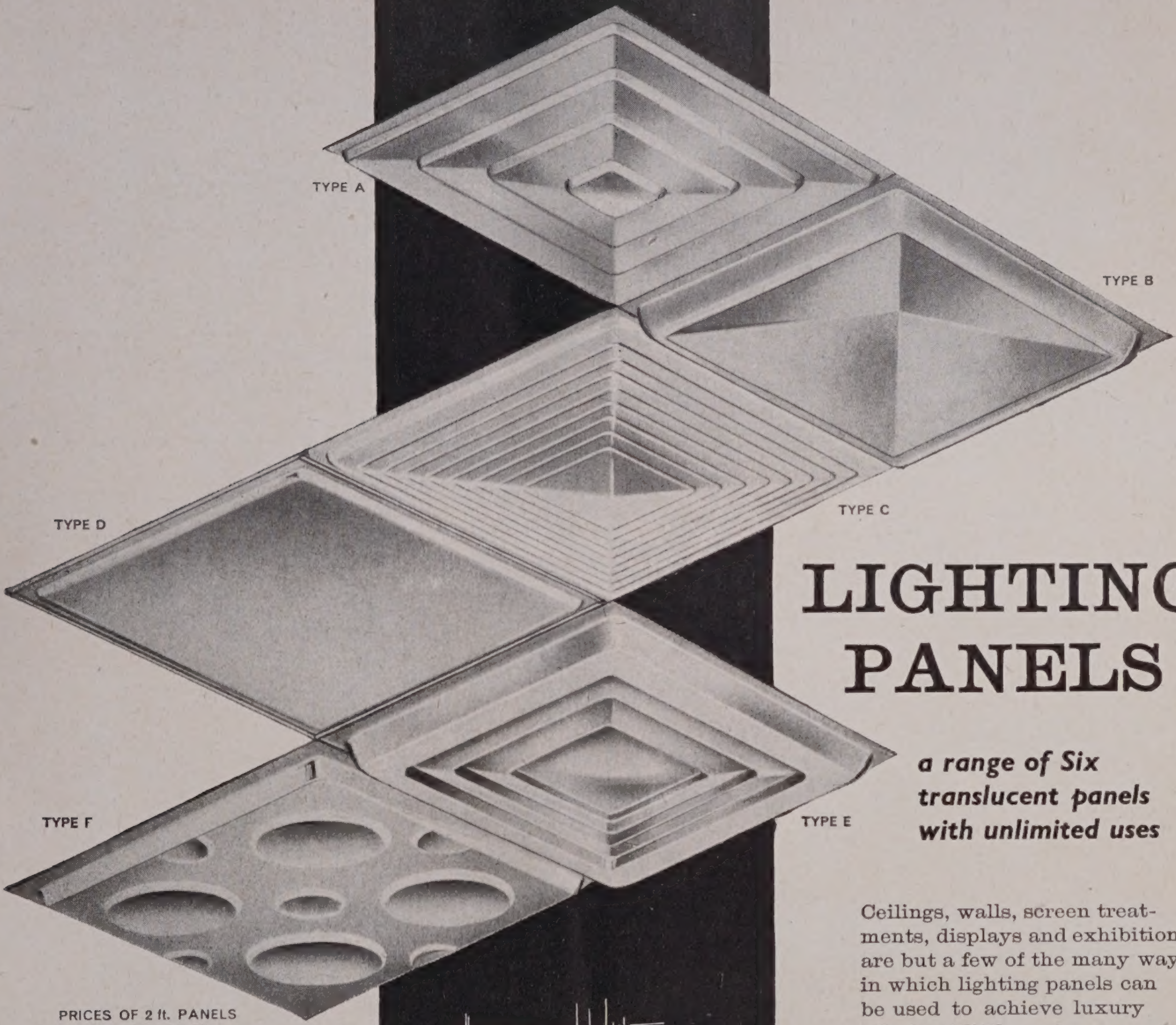
Photograph by courtesy of F. P. Walters. Esq., Engineer, Surveyor and Water Engineer, Alfreton U.D.C.

This illustrates one of many designs approved by the Council of Industrial Design and acceptable to the Ministry of Transport for use on trunk roads.

A booklet illustrating our range of columns is available on request to the Concrete Sales Department.


STANTON
prestressed spun concrete lighting columns
TO B.S. 1308: 1957
ALL STANTON GROUP 'A' LIGHTING COLUMNS ARE ACCEPTABLE TO THE MINISTRY OF TRANSPORT FOR TRUNK ROAD LIGHTING

**THE STANTON IRONWORKS COMPANY LIMITED NEAR NOTTINGHAM**



# LIGHTING PANELS

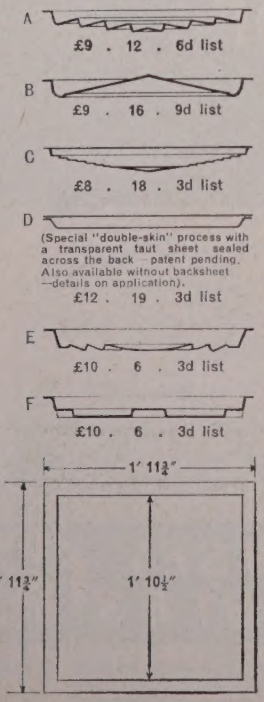
***a range of Six translucent panels with unlimited uses***

Ceilings, walls, screen treatments, displays and exhibitions are but a few of the many ways in which lighting panels can be used to achieve luxury effects at little cost.

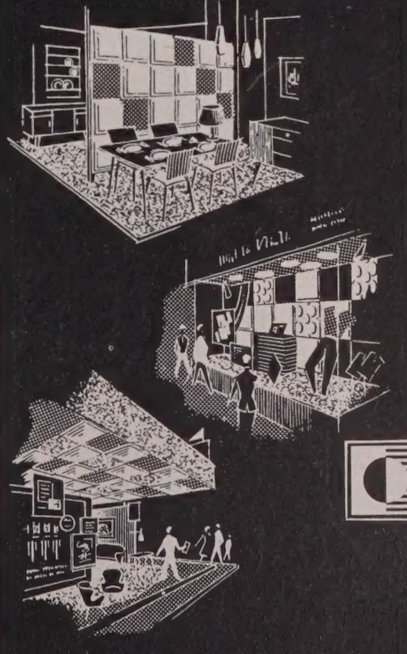
The Lighting Specialists offer a range of nominal 2ft square formed plastic panels — excellent diffusing qualities, light and easy to handle. Minimum order 6 panels — pre-packed, direct from stock.

These panels can also be supplied nominal 3′ x 3′ to customers' special requirements.

PRICES OF 2 ft. PANELS
*PER PACK OF SIX*



| | |
|---|---|
| A | £9 . 12 . 6d list |
| B | £9 . 16 . 9d list |
| C | £8 . 18 . 3d list |
| D | (Special "double-skin" process with a transparent taut sheet sealed across the back — patent pending. Also available without backsheet —details on application).<br>£12 . 19 . 3d list |
| E | £10 . 6 . 3d list |
| F | £10 . 6 . 3d list |



A HOST OF APPLICATIONS

**COURTNEY, POPE**

**COURTNEY, POPE (ELECTRICAL) LTD.**
AMHURST PARK WORKS
Tottenham, London, N.15
*phone:* STAmford Hill 1270 *(fifteen lines)*

**LONDON · MANCHESTER · LEEDS · BIRMINGHAM**

# Mersey make shaped conductor P.V.C. insulated power cables

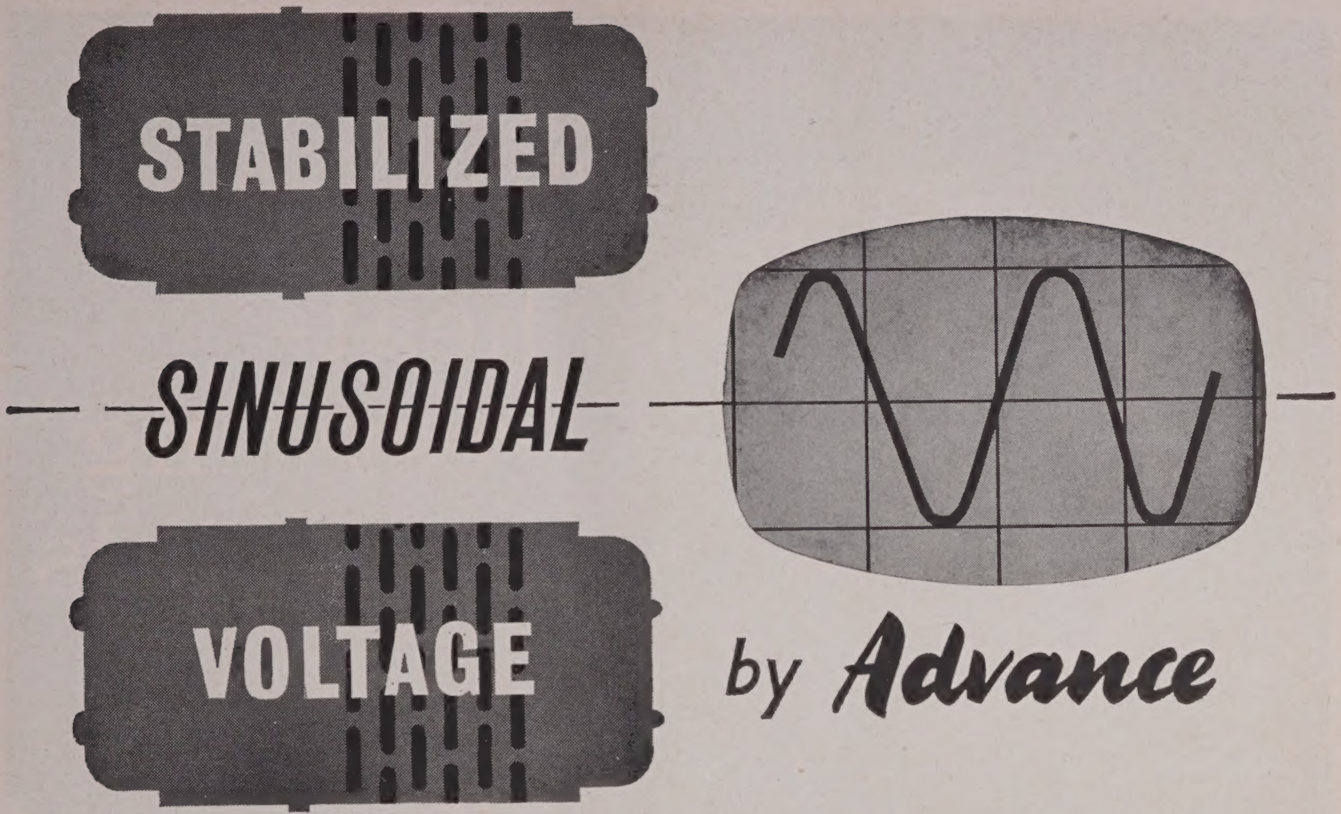
MG.2

Used in all situations where the keyword is reliability, Mersey Cables are ruggedly made for underground power distribution. Shaped Conductor PVC Insulated Power Cables can be installed and forgotten. But don't forget that Mersey are the versatile cable people, with a wide range and a reputation for service. There's a Depot listed in your 'phone book, so get in touch today.

**MERSEY CABLES**

ELECTRICAL DIVISION

MERSEY CABLE WORKS LIMITED, LIVERPOOL 20 *Telephone:* BOOTLE 4111



## the CVH RANGE

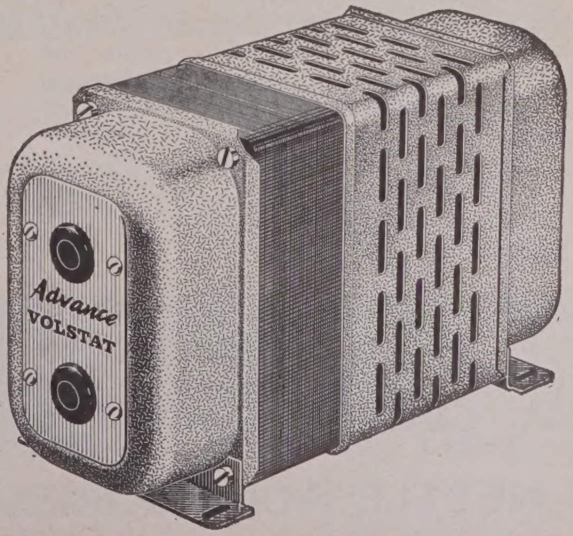
# VOLSTAT

Advance constant voltage transformers are available in the CVH range with low harmonic distortion in the output wave-form, ideal for use with precision equipment sensitive to power frequency harmonics, and also with all equipment requiring a constant voltage sinusoidal input.

In most applications the harmonic distortion present in the output waveform will not exceed 3%. Under the most unfavourable conditions this figure will not rise substantially above 5%. When used with a rectifier to provide a d.c. supply, the characteristics of the system are identical to the normal mains source and particularly close regulation of the output is obtained.

| Type | I/P V Range | O/P V r.m.s. | Watts | p.f. | Nett Price in U.K. |
|---|---|---|---|---|---|
| CVH 60A | 190–260 50~ | 240 | 60 | 1·00 | £10 10 0 |
| CVH 125A | 190–260 50~ | 230 | 125 | 1·00 | £17 0 0 |
| CVH 420A | 190–260 50~ | 230 | 420 | 1·00 | £37 0 0 |
| CVH 750A | 190–260 50~ | 230 | 750 | 1·00 | £68 0 0 |
| CVH 1500A | 190–260 50~ | 230 | 1500 | 1·00 | £99 0 0 |
| CVH 3000A | 190–260 50~ | 230 | 3000 | 1·00 | £185 0 0 |
| CVH 6000A | 190–260 50~ | 230 | 6000 | 1·00 | £355 0 0 |

- CONTINUOUS AND AUTOMATIC STABILIZATION
- RAPID RESPONSE TIME
- CURRENT LIMITING CHARACTERISTIC
- COMPACT DESIGN
- NO MOVING PARTS
- NO ROUTINE MAINTENANCE

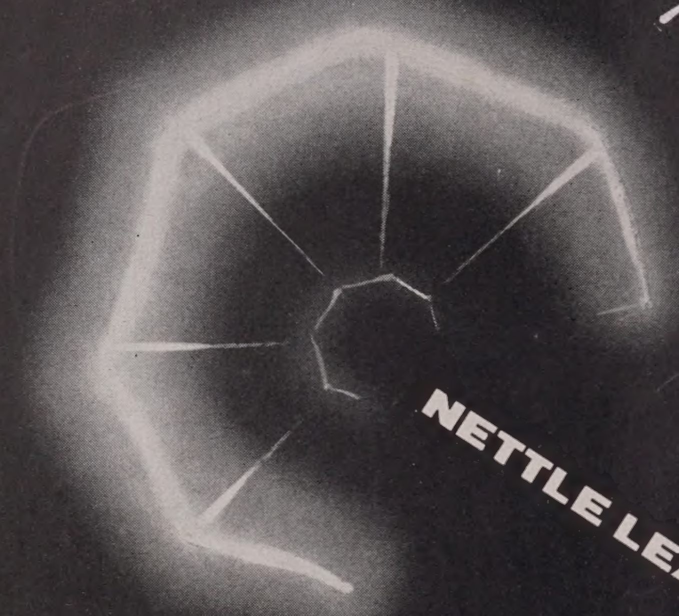


**Advance** COMPONENTS LIMITED

**MAINS STABILIZATION DIVISION**

ROEBUCK ROAD • HAINAULT • ILFORD • ESSEX • TELEPHONE : HAINAULT 4444

IT/D22



*new heat-resisting materials

NETTLE LEADS THE FIELD

* IN ACCORDANCE WITH BS. 52 SUP. No. 1.

**Designed for the modern planned interior . . . . .**

A completely new conception in lampholder design, the NETTLE "1000" range offers, to architect and interior designer, a comprehensive choice of pendant and batten-type lampholders, designed in contemporary style.

These fittings, in white, black or dove grey, are in accordance with Supplement No. 1 to B.S. 52, and are very competitively priced.

**NETTLE 1000 RANGE**

REGD. DESIGN No. 888492·4

**Selected by the Council of Industrial Design for display at the Design Centre. Prizewinning exhibit at the 1959 A.S.E.E. Exhibition**

**NETTLE ACCESSORIES LTD.,**

Sales Division, Warren Street, Stockport, Cheshire
Telephone : STOckport 7155
A MEMBER OF THE AERIALITE GROUP OF COMPANIES

DEPOTS AT
LONDON
MANCHESTER
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BRISTOL
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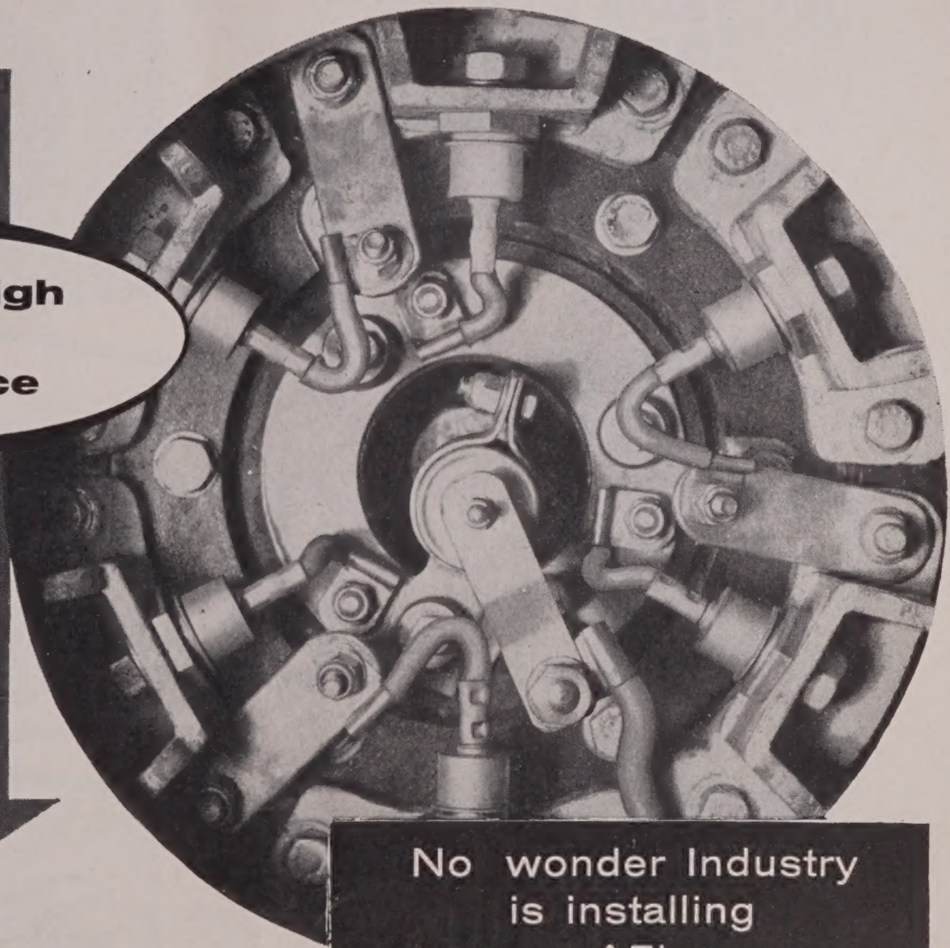
BELFAST

CW 7605

# The case for brushless is overwhelming!

**Just weigh the evidence**



**No wonder Industry is installing AEI BRUSHLESS A.C. GENERATORS**

Maintenance costs cut dramatically . . . because there are *no* brushes to inspect or replace, *no* carbon brush dust to endanger insulation, *no* sliprings to be re-ground, *no* commutator to be skimmed.

Because sparking cannot occur fire risk is inherently low.

AEI brushless A.C. generators are particularly useful for standby duty and for service in situations remote from grid supplies.

Despite all their advantages brushless A.C. generators cost no more than alternative equipment and are available in an extensive range from 50 kVA up to 5,000 kVA.

*Write now for leaflet to:*

AEI

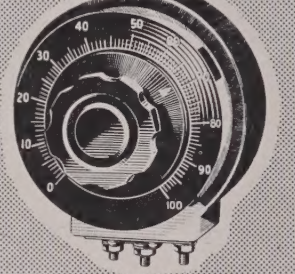
**Associated Electrical Industries Limited**
**Heavy Plant Division**
RUGBY, ENGLAND

A5583

**Better make it Birch**

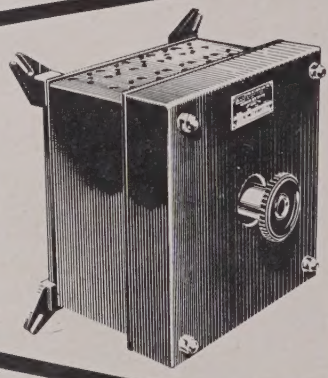
*for* **TOROIDAL RESISTORS**

FORMER. Patented ceramic moulding with horizontal opposed copper graphite internal brush movement. WINDING. Best quality resistance wires to B.S.S.115. Write for list No. 130.



*for* **STUD TYPE RESISTORS**

Stud type Regulating Resistors of front-of-board or back-of-board patterns. All resistors are fully tested for correct grading, insulation resistance and minimum high pressure test of 2,000 volts F.M.S. A.C. for one minute.
Write for list No. 120.



*for* **VITREOUS ENAMELLED RESISTORS**

FERRULE END TYPE (JOINT SERVICE—TYPE APPROVED) 9 SIZES—10-250 WATT

Fully vitrified porcelain former winding 80/20 nickel chrome wire. High rating, liberal safety margin and tolerance.

WIRE END TYPE 7 SIZES—1½ to 30 WATT Axial or Radial leads, tinned, securely fixed to the unit and capable of supporting the weight of the resistor, which can therefore be soldered in to equipment. Write for list No. 190.

**Birch make it better**

H. A. BIRCH & CO. LTD., WOOD STREET, WILLENHALL, STAFFS.
Telephone: WILLENHALL 494-495 Grams: Wilohm, Willenhall
LONDON OFFICE: HERGA WORKS, WALLINGFORD ROAD, UXBRIDGE, MIDDLESEX
Telephone: UXbridge 5211

# Wash - Rinse - Dry

## SMALL METAL PARTS

## WITH STURTEVANT MACHINES

SPECIALISTS IN
ALL TYPES OF FANS
HEATING AND VENTILATION
AIR CONDITIONING
AIR FILTRATION
FUME REMOVAL
DRYING
DUST COLLECTING
ELECTROSTATIC PRECIPITATION
PNEUMATIC CONVEYING
INDUSTRIAL VACUUM CLEANING
CRUSHING, GRINDING, SCREENING
AND SEPARATING
CATHODIC PROTECTION

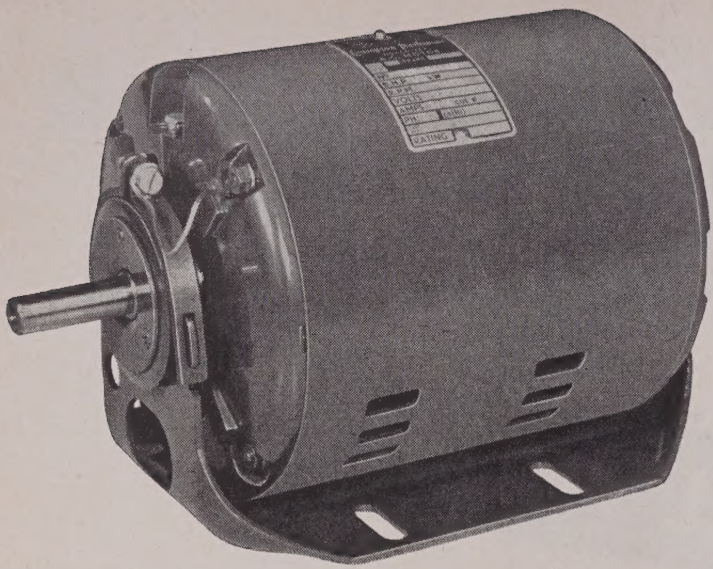
Sturtevant
CLEAN AIR

| | |
|---|---|
| AUTOMATIC | **Continuous process from intake to discharge** |
| FLEXIBLE | **Supplied as complete units or in three stages—washing, rinsing, drying** |
| VERSATILE | **Suitable for wide range of applications** |
| ECONOMIC | **Designed for use with any heating medium** |
| COMPACT | **Constructed on space-saving lines** |

*Our publication U 4709 describing these machines will be supplied on request*

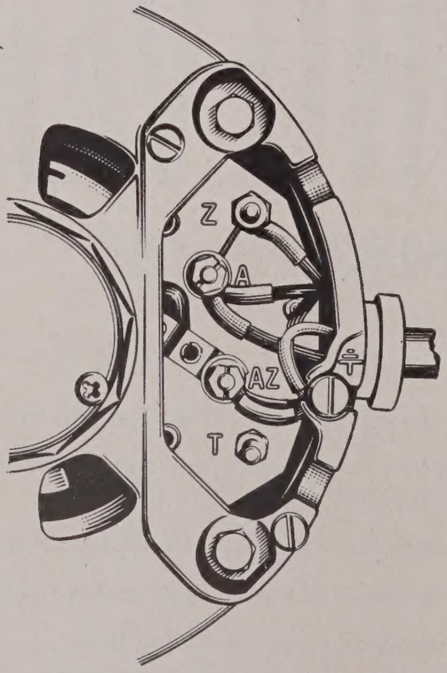
**STURTEVANT ENGINEERING CO. LTD., SOUTHERN HOUSE, CANNON STREET, LONDON, E.C.4**

**AUSTRALIA: STURTEVANT ENGINEERING CO. (AUSTRALASIA) LTD., MILLER ROAD, VILLAWOOD, N.S.W.**



The design of a really first-class F.H.P. motor begins, you might say, where the design of larger motors ends. For F.H.P. motors are made in very large numbers and yet have to be quite exceptionally reliable (the reputation of other equipment may depend on them). They must be capable of being serviced anywhere and must be particularly simple to install. The means to achieve these things are not found in text books. They can be learned in only one way – detail by detail over many years of making F.H.P. motors. They are, in short, what is meant by . . .

# This thing called know-how



Take the rear cover of one of our F.H.P. motors. It looks ordinary enough but it is in fact a remarkably successful piece of detail design. Within its small diameter, room has been found for a terminal box far larger than is usual on F.H.P. motors (which makes installation quicker), a very large oil reservoir for the bearing (which reduces maintenance) and large ventilation openings. Moreover, the cover has to be made at a competitive price. This kind of design comes of experience, and a great deal of unwritten knowledge is built into it.

**Crompton Parkinson**
**LIMITED**

ELECTRICAL EQUIPMENT

Makers of Electric Motors of all kinds, A.C. and D.C. Generators, B.E.T. Transformers, Switchgear, Cables, Instruments, Lamps, Lighting Equipment, Batteries, Stud Welding Equipment, Traction Equipment, Ceiling Fans.

**CROMPTON PARKINSON LTD · CROMPTON HOUSE · ALDWYCH · LONDON · WC2**

F611

KEEPING

DANGER

at a distance

That distance, whether it be governed by steel bars or wire mesh, can represent the difference between safety and serious injury. Machinery and tools—often running at high speeds—can be as productive of danger as any wild animal; and it is only good sense to cut this risk by using efficient and properly designed guards and fencing.

'Harco' Machinery Guards are purpose made for every type of machinery, and are constructed to afford complete protection without interfering with efficient operation. They are strongly made from stout wire mesh, and fully conform to Factory Act requirements.

The complete Harvey service covers advice, design and installation, and List No. 996 shows many types already supplied.

**'HARCO' MACHINERY GUARDS**

*Other HARVEY Facilities and Products:* PERFORATED METALS · WOVEN WIRE · WIREWORK OF ALL KINDS · GALVANIZING · STEEL SHELVING AND STORAGE BINS · BAR AND TUBE RACKS · FABRICATIONS IN ALL METALS · MACHINING AND FITTING

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G. A. HARVEY & CO. (LONDON) LTD., WOOLWICH ROAD, LONDON, S.E.7
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wwa

ENGLISH ELECTRIC LIBERATOR TUMBLE-DRY
When it rains . . . it sells
English Electric Liberator Tumble-Dry

Actually the Liberator Tumble-Dry sells all the time, rain or shine. And now that housewives are beginning to realize just how much *more* the Tumble-Dry does compared with a spin-dryer (it dries anywhere from damp-dry to bone-dry, aired and ready to put on) it's going to sell better than ever before. The Tumble-Dry has lots of advantages over other tumble-type dryers too. When the English Electric representative calls next, ask him about the six big advantages of the English Electric Liberator Tumble-Dry.

**THE ENGLISH ELECTRIC COMPANY LIMITED, DOMESTIC APPLIANCE DIVISION, LONDON AND LIVERPOOL**

. . . Media rewirable switchfuses are newly designed for really easy installation and maintenance, attractively styled. This range of N W P ironclad switchfuses with positive quick make and break includes single and triple pole each with neutral block, and double and triple pole models, in 15, 30 and 60 amp ratings, complying with B.S.S. 2510, 861 and 816 and I.E.E. regulations.
Have you got our leaflet?

**REVO ELECTRIC**

REVO ELECTRIC CO. LTD., TIPTON, STAFFORDSHIRE

*A Duport Company famous for cookers, fires, fluorescent and industrial light fittings, power tools, street lighting, switch and fusegear etc.*

W & W 64

**DESIGNED TO TAKE IT**

NIFE Steel Alkaline batteries are not finicky or fussy. Electrically and mechanically, they take the rough with the smooth. Even severe shock and continuous vibration will not harm them.

They will withstand widely varying electrical conditions without damage, including the delivery of continuous high currents down to short circuit, followed by rapid re-charging. For emergency or intermittent use, NIFE batteries are the logical choice. After standing by for some years they will respond as if freshly charged. They are compact, light in weight, and will give the longest life with the minimum of maintenance.

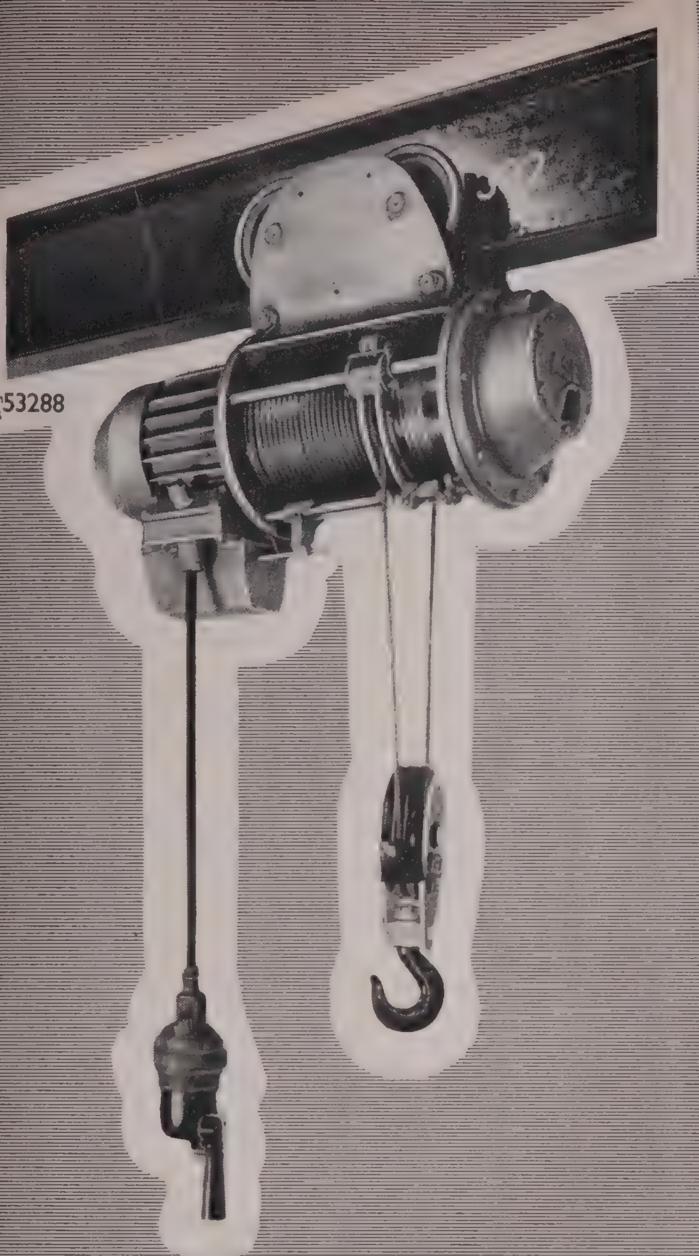
*Far-sighted engineers specify them for* TRAIN LIGHTING · AUTOMATIC TRAIN CONTROL EMERGENCY TRAIN LIGHTING · SEARCHLIGHTS AND INSPECTION SETS DIESEL ENGINE STARTING · BATTERY ELECTRIC TRUCKS · SWITCHGEAR OPERATION ALL FORMS OF TRACK AND SIGNAL CONTROL

**FIT FOR A LONG LIFE** **NIFE**

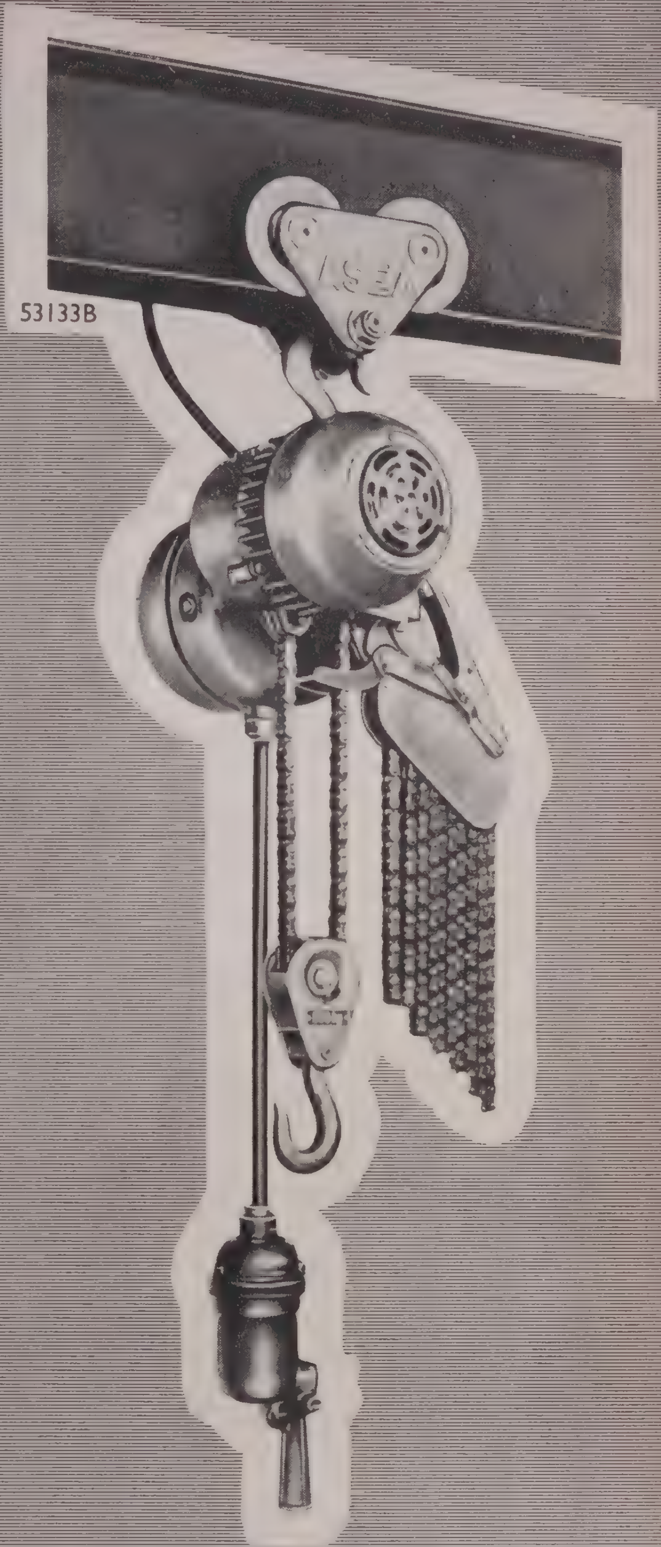
STEEL ALKALINE BATTERIES

NIFE BATTERIES · REDDITCH · WORCESTERSHIRE

TGA NI53



53288



53133B

**53133B** 5 cwt. and 10 cwt. capacity Roller Chain Hoists. (Type TEA) with single and two speed lifting. Hook and trolley suspension.
**53288** 1 ton Wire Rope Hoists (Type TMA) with single and two speed lifting.

consult—

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ELECTRIC

A member of the Hawker Siddeley Group
*Sole U.K. representative for*
*ASEA Svetsmaskiner AB Stockholm.*
FULLER ELECTRIC LIMITED
FULBOURNE ROAD · LONDON E.17
Telephone: LARkswood 2350

*Also at Birmingham, Glasgow and Manchester*

# NEW RANGE OF POWER-PACKED HOISTS BY ASEA

Built for continuous heavy service, this new range of electric hoists is based on ASEA's 50 years' experience in hoist design. Patented brake release mechanism by parallel rotor and incorporating high safety factor with light weight design.

**DELIVERIES:** Approximately 8 weeks for new range. Larger capacities, i.e. 2-5 tons in current range, ex-stock.

ASEA

PHILIPS

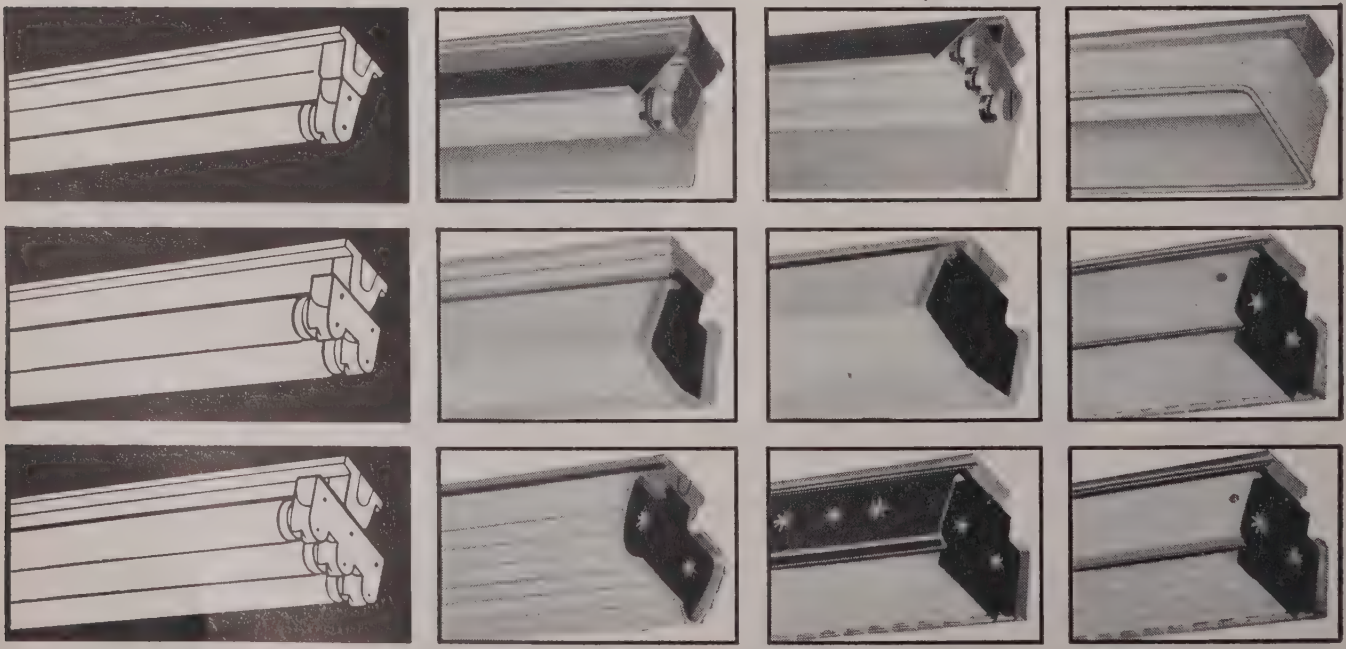
# streamlite is here!

The newest, slimmest lighting fittings for 1, 2 and 3 lamps 5ft. 80w (1 & 2 lamps 2ft. 20w, 4ft. 40w)—with a big range of reflector and diffuser attachments

Philips Streamlite – it's the newest thing in fluorescent lighting fittings. And it outdates every other type of fitting on the market. For Philips Streamlite – so slim, so sleek, so stylish – has far more to offer than any other fluorescent fittings you can buy, including some advantages that are as unique as they are striking:

- *Philips Streamlite gives you Switch and Switchless start in the popular sizes.*
- *There is a choice of one, two or three lamp fittings – all equipped with Philips even slimmer Polyster ballasts.*
- *There is a fine range of diffusers and reflectors.*
- *It is extraordinarily reasonable in price.*
- *B.S. Box fixing and conduit entries at 24″ centres. (B.S. 2467) 2 ft. 20w. 17½″ centres.*
- *Variable fixing centres for B.S. Boxes where used with slide-grip hangers.*
- *For single* and *continuous mounting.*
- *Philips Sprung Rotor lampholders with earth plungers for lamp end-caps – rapid fixing, automatic positioning.*
- *10 amp. mains terminal block, and earth connection.*
- *Full length back plate with rigidly secured cast alloy ends providing earth continuity for end-entry conduit.*
- *Easily removed plastic inserts for end-conduit entries.*
- *Cable way for through wiring: cable cleats provided.*

**They'll be in big demand – order now!**



**PHILIPS LEAD THE WORLD IN LIGHTING**

PHILIPS ELECTRICAL LTD · CENTURY HOUSE · SHAFTESBURY AVENUE · LONDON WC2

(LD3284J)

FREDERICK SMITH & COMPANY ANACONDA WORKS · SALFORD 3 · LANCS

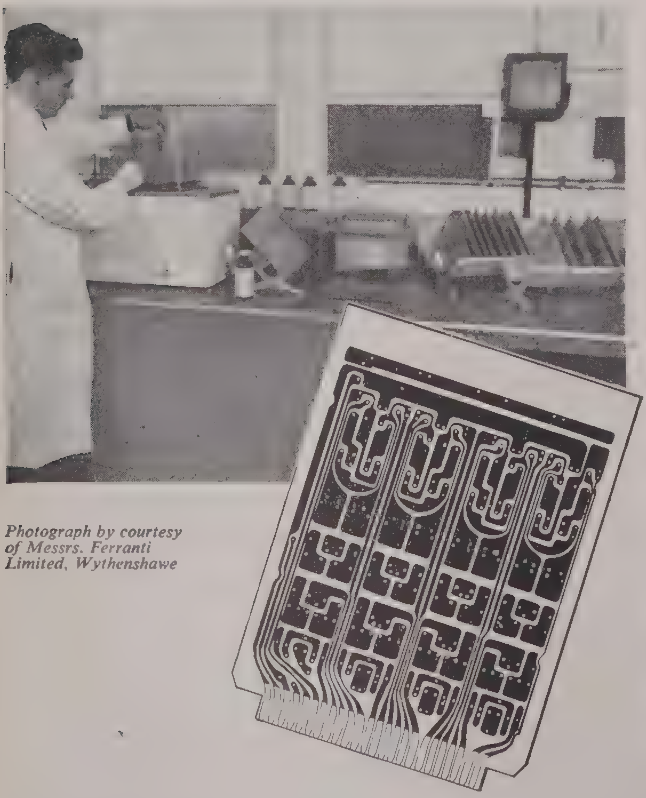
# DEPOSIT OF 3 MG/IN² NOW OBTAINABLE WITH 'ATOMEX' IMMERSION GOLD SOLUTION

A major advance in the technology of the deposition of gold has been made as the result of Engelhard research in the further development of the 'Atomex' electroless gold deposition process.

A dense deposit of pure gold up to 3 mg/in$^2$ (previously 0.7 mg/in$^2$) may be obtained using a simple immersion procedure, yet adhesion of the gold deposit to the base metal is excellent.

This process is finding increasing use in printed circuitry where copper foil printed circuits may be treated, as a result of which they will retain their solderability for at least twelve months.

* ***Write for full information and new literature.***



*Photograph by courtesy of Messrs. Ferranti Limited, Wythenshawe*

**ENGELHARD INDUSTRIES LTD.**

BAKER PLATINUM DIVISION
52 HIGH HOLBORN · LONDON WC1 · *CHAncery* 8711

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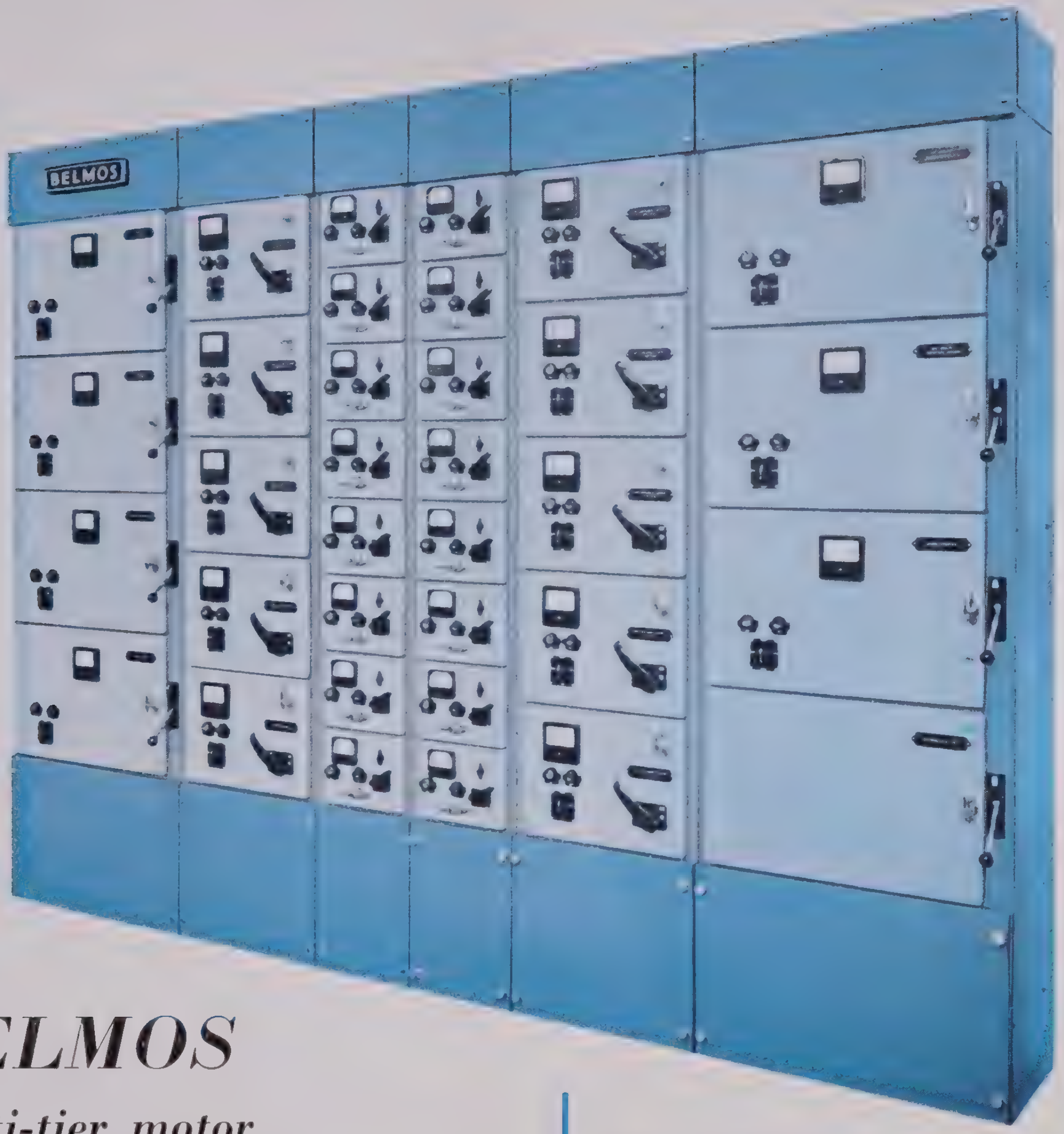
# H.R.C. Cartridge Fuse Links

- B.S.88 CATEGORY OF DUTY, AC4
- A.S.T.A. TEST CERTIFICATE Nos. 2050–2054
- **Ratings up to 300 Amps, 440 Volts**
- *Illustrated Pamphlet and Price List from—*

**L. WEEKES (LUTON) LIMITED**

**WINGATE ROAD, LUTON, BEDS**
*Telephone: LUTON 51478* *Telegrams: "SAFETEE LUTON"*



# BELMOS

## *multi-tier motor control gear*

### *"G" RANGE*

Introduced a few years ago, the "G" range of 4- and 5-tier cubicles has become firmly established for group control of motors up to 90 h.p. at 440 volts. The enclosures have now been further developed to incorporate several additional features, including automatic sequence starting and individual earth leakage protection.

### *"H" RANGE*

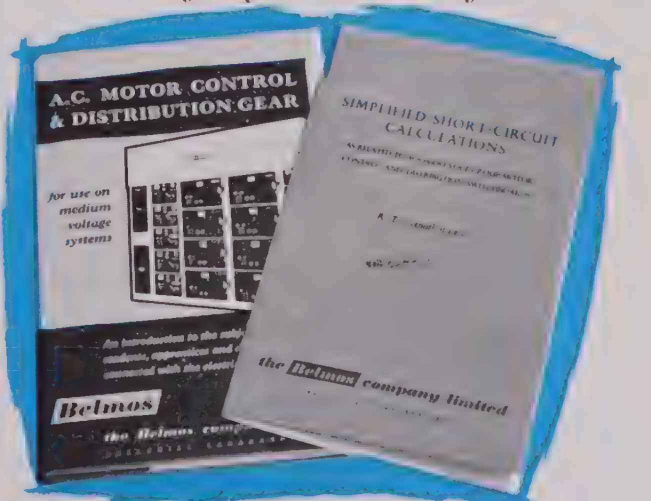
The 8-tier cubicles of the "H" range accommodate contactor starters suitable for 7½ h.p. motors. The contactors are mounted in plug-in chassis which can be withdrawn for maintenance. As the photograph shows, "G" and "H" range units can line up together to form a flush-fronted controlboard.

**Belmos**

***the Belmos company limited***

BELLSHILL - LANARKSHIRE

## *New books for your bookshelf . . .*



**"A.C. MOTOR CONTROL AND DISTRIBUTION GEAR"**
Includes sections on circuit diagrams, sequence and control circuitry, protection and short-circuit problems.
95 pages. 117 illus. Price 15/- post free.

**"SIMPLIFIED SHORT-CIRCUIT CALCULATIONS"**
For non-mathematicians
Worked examples with diagrams show how.
32 pages. 22 illus. Price 5/- post free.

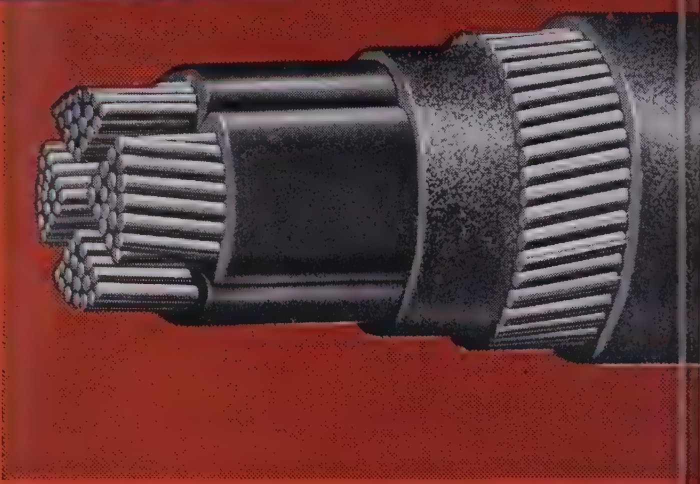
LONDON GLASGOW BIRMINGHAM NEWCASTLE MANCHESTER SHEFFIELD CARDIFF

60 YEARS OF PROGRESS . . .

P.V.C. INSULATED POWER CABLES

Available for the same conductor range as for Paper Insulated Cables, to B.S. 480/1954, for voltages up to and including 3.3 Kv.

*Send for publication No. B16*

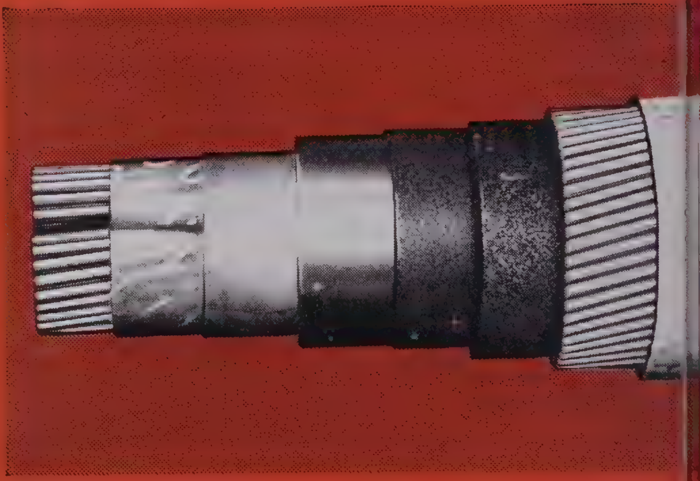


CONNOLLYS

PAPER INSULATED POWER CABLES

Standard range covers 1,100 volts to 11,000 volts with full range of armouring and overall protection with bituminous textiles or P.V.C.

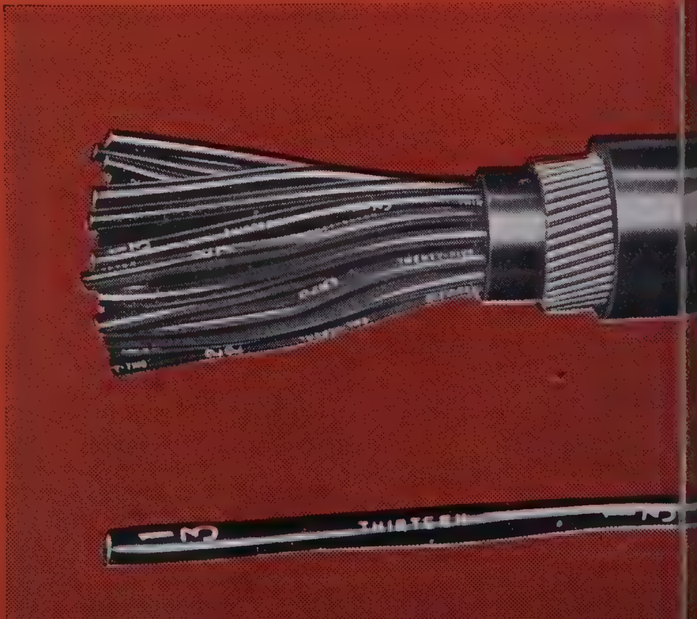
*Further details on request.*



PILOT AND CONTROL CABLES

A range of power and control cables is available at voltages up to 1,100. To facilitate identification, the P.V.C. insulated cores are clearly printed at frequent intervals with the appropriate legend and numerals. The laid up cores are sheathed with P.V.C. and can be armoured and P.V.C. protected if required.

*Further details on request.*



## TELECOMMUNICATION CABLES

Connollys plastic insulated and sheathed cables are servicing telephone administrations throughout the world. Cables can be armoured with protected galvanised steel if there is a danger of mechanical damage, or they can be supplied with inbuilt catenary for overhead suspension. All cables are suitable for installation in tropical conditions.

*Send for publication B.11A (Polythene Insulated) and publication B.14A (P.V.C. Insulated)*

# FOR CABLES

## WIRING SYSTEM CABLES

Connollys stock a wide range of plastic insulated and sheathed cables in accordance with B.S. 1557/1954 (Polythene insulated, P.V.C. sheathed) and B.S. 2004/1955 (P.V.C. insulated, P.V.C. sheathed).

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## 'BLACKLEY' INSULATING TAPE

'Blackley' Tape has been produced by Connollys since 1895 and its adhesive and insulating properties are appreciated throughout industry. The adhesive surfaces never 'strip' because the rubber compound is frictioned on to both sides of specially woven cloth. Available in widths ½″ to 2″ in 5, 10, 25 and 50 yard rolls.

*Send for publication No. B.12.*

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**CABLE DIVISION**

## CONNOLLYS (BLACKLEY) LIMITED

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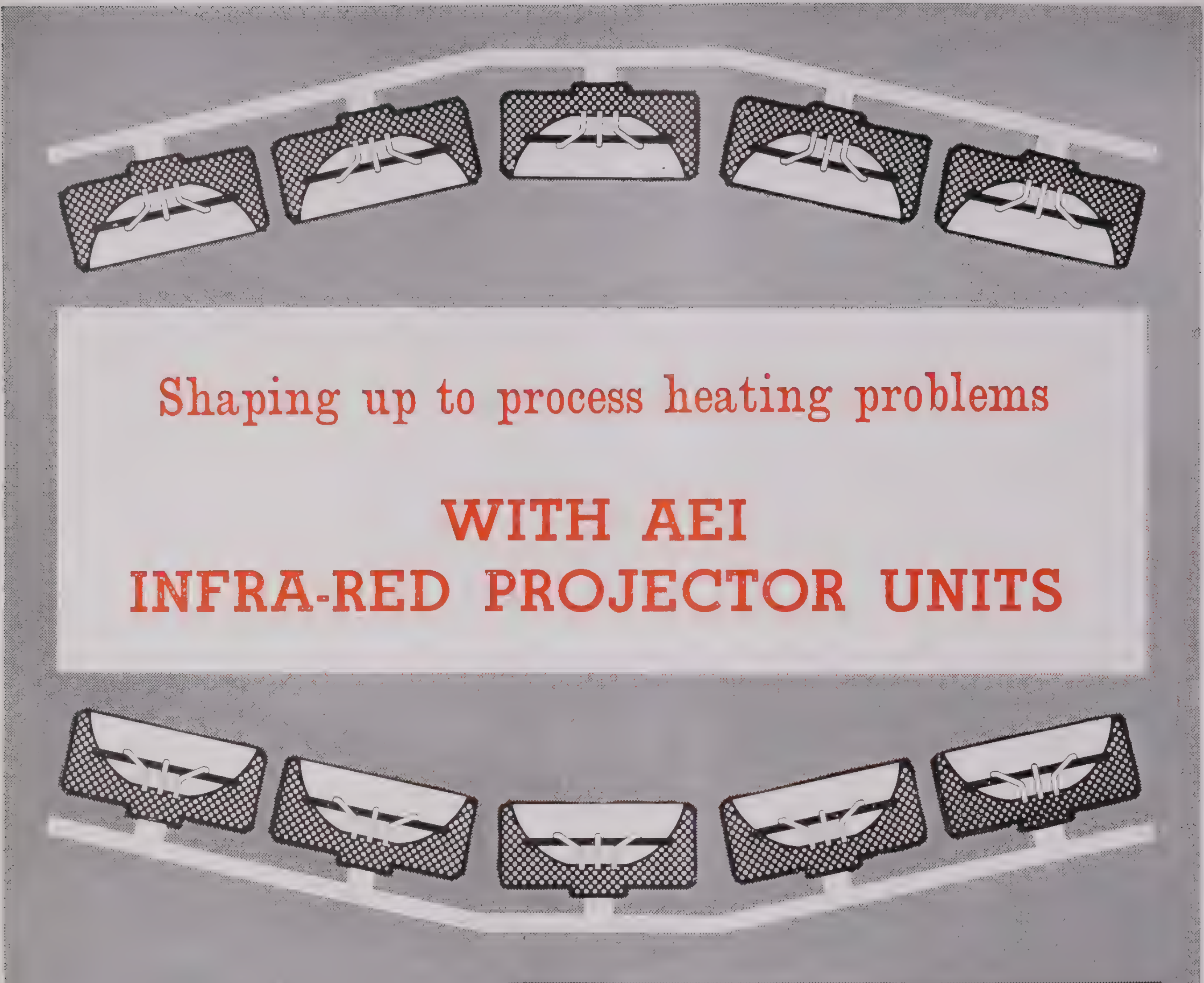
CL.54



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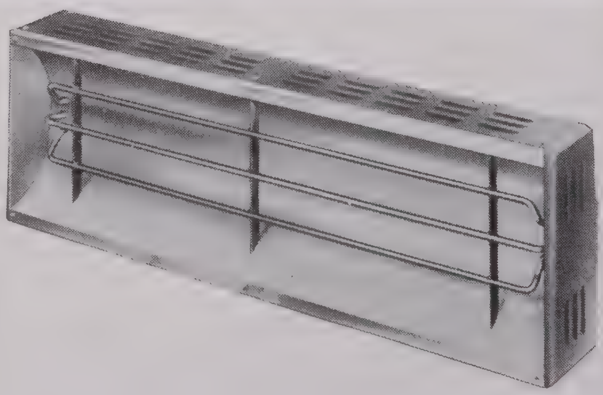

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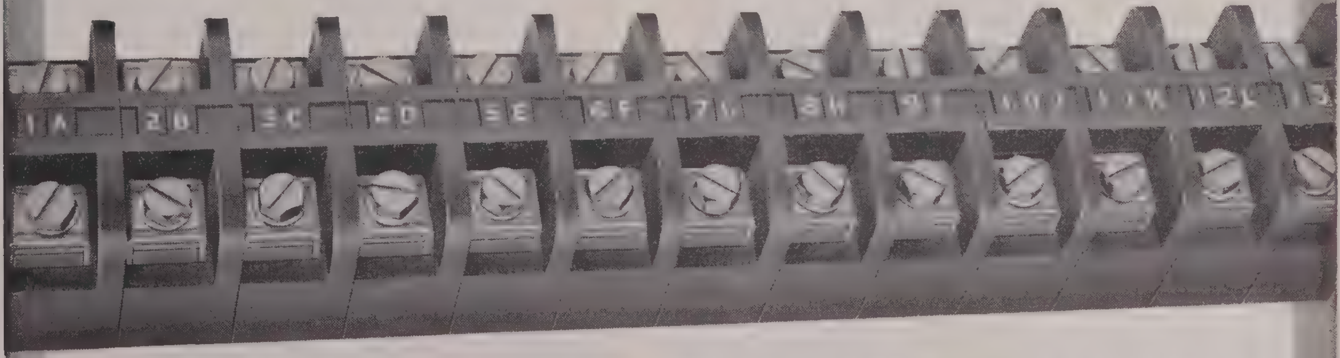
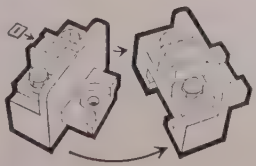


**MTE MULTI-LOCK TERMINAL BLOCKS**



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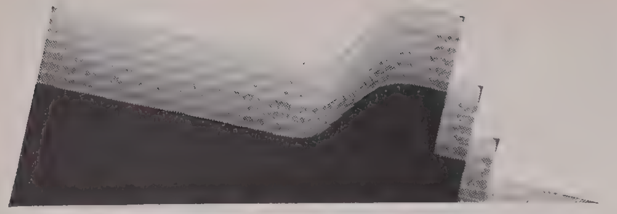

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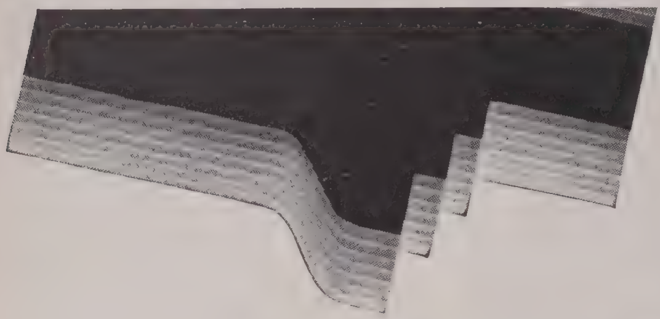

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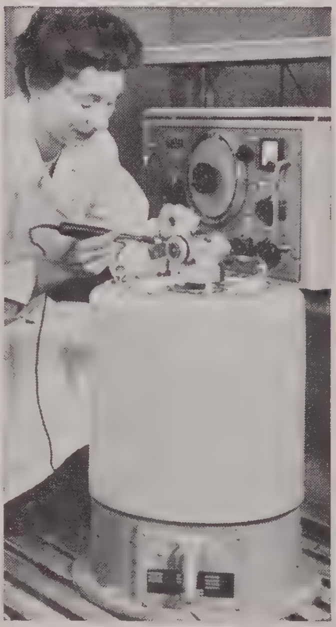

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| for earthing cables up to | 7/0.036″ | 7/0.064″ | 19/0.064″ | 19/0.083″ |
| to fit B.S. conduit sizes | 1, 2 & 3 | 4 & 5 | 6 & 7 | 8, 9 & 10 |
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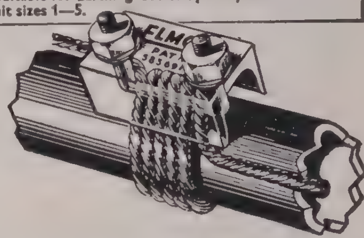
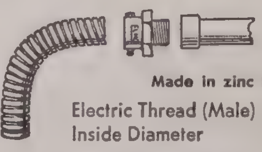
| **NOTE ALSO:** Type A123 is suitable for Earthing Cables up to 7/0.029″ and for B.S. conduit sizes 1—5. | | | | |

"Elmo" Earthing Clamps are of robust construction. Impossible for wire to pull out, always under tension, therefore a most satisfactory earth and a permanent safeguard.



# ELECTRICAL FITTINGS



Flexible-to-rigid
## CONDUIT COUPLINGS

**Made in zinc base alloy in the following sizes:**

| | |
|---|---|
| Electric Thread (Male) | ⅝″ ¾″ 1″ 1¼″ 1½″ 2″ |
| Inside Diameter | ⅝″ ¾″ 1″ 1¼″ 1½″ 2″ |
| Electric Thread (Male) | ⅝″ ¾″ 1″ 1¼″ |
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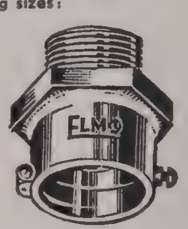

## WITH EARTHING TERMINAL

Special Features: Integral Earthing Terminal, tinned ready for soldering. Fixing screw for continuity. Internal Threads suit all makes of flexible tubing.

MALE
Hex. Section

## CONDUIT BUSHES

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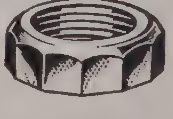
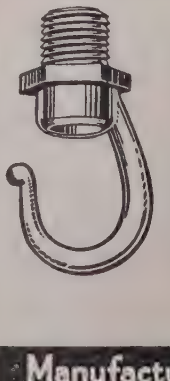
FEMALE: Electric Thread
⅝″ ¾″ 1″ 1¼″ 1½″ 2″



FEMALE
Flat Face Section for Spanner (except ¾″ size which is round)



## CONDUIT HOOK

For fluorescent lamps and overhead lighting fittings. Screwed ¾″ thread, male electric. Made to fit all standard boxes with two holes 7/32″ diameter —2″ centres diametrically opposed. Designed in accordance with British Standard Specification.

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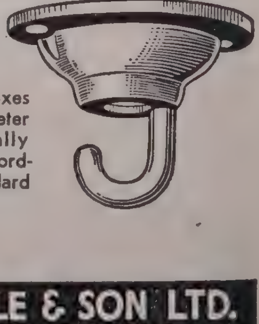
One hook



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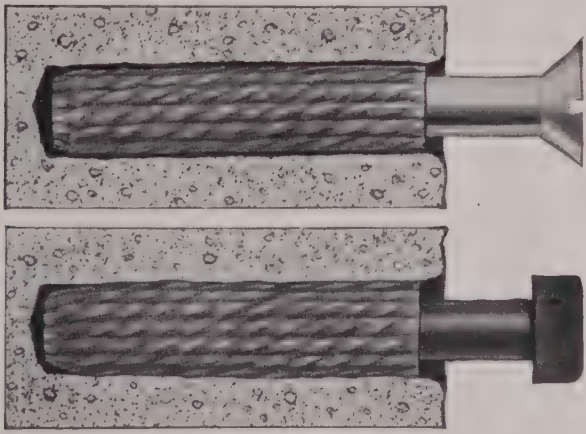

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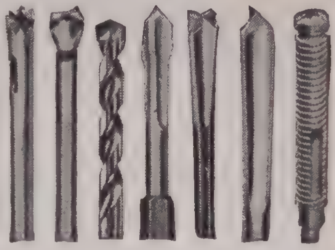

For cutting holes in any material—concrete to glass—Rawlplug tools are the speediest, most efficient and durable in the world. Sizes and types to meet every need—hand, electric or air power. Among hand percussion tools are Rawldrills, Stardrills, Tubular and Wall Boring Tools. For hand or power—Durium, the world's fastest masonry drill, and Durium Glass Drills. Power only—Vibroto, Rawlcrete, Durium Hammer Drills, etc.

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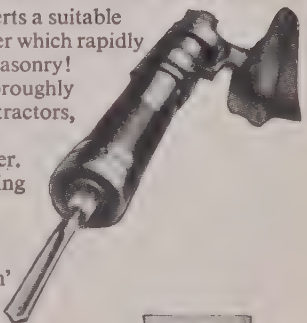
***Keyless Chuck***

At the touch of a button you can change the speed of this drill from 1200 r.p.m. to 420 r.p.m. which is the ideal speed for Durium Masonry Drills. Chuck capacity is 5/16″. Finger tightening holds the smallest drill in rigid grip which increases with the load yet can be easily released.

## RAWLPLUG DRILL HAMMER



This ingenious attachment converts a suitable electric drill into a Power Hammer which rapidly bores holes in even the hardest masonry! A sturdy high-precision tool, thoroughly proved and used by famous Contractors, the Rawlplug Drill Hammer is a magnificent time-and-money saver. Suits any electric drill with working speed up to 2000 r.p.m. and minimum ½″ chuck. Speed—one blow per chuck rev. Weight of blows adjustable 'light', 'medium' and 'heavy'.

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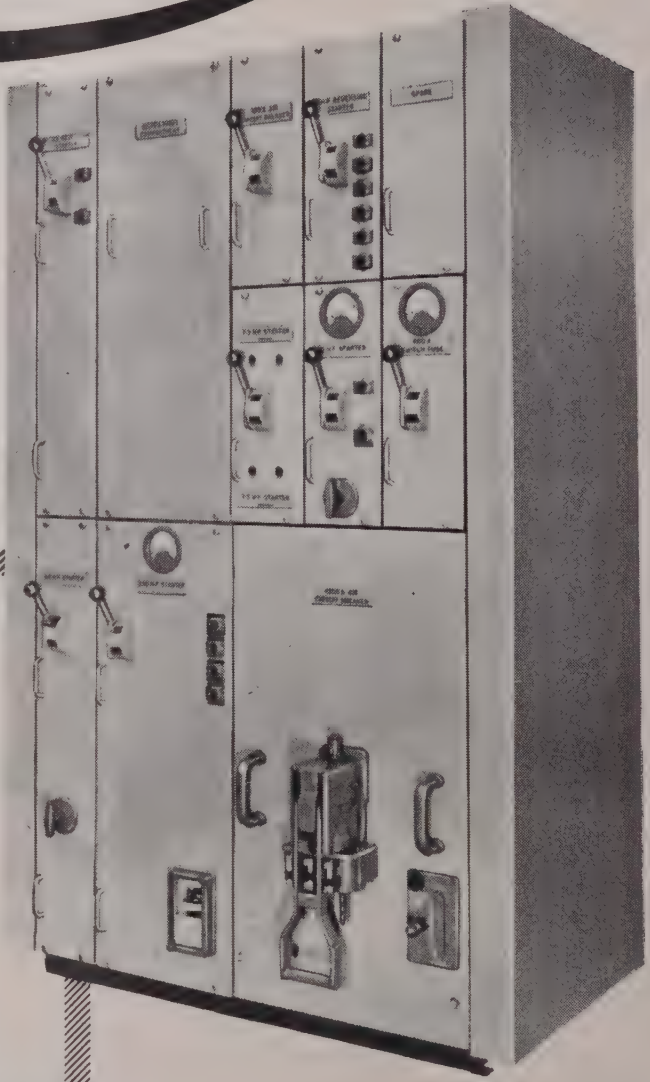

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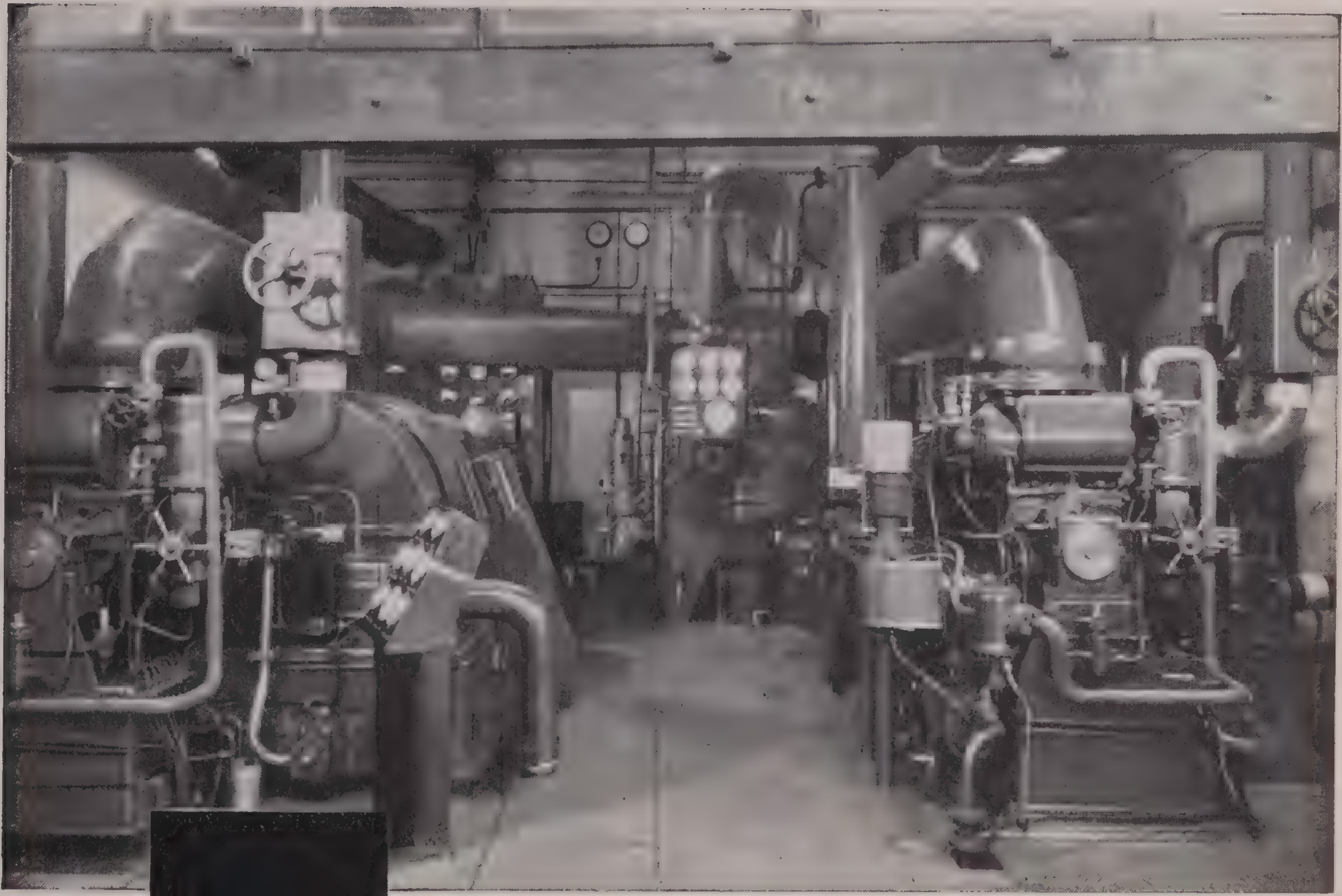

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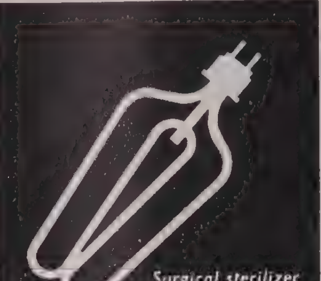
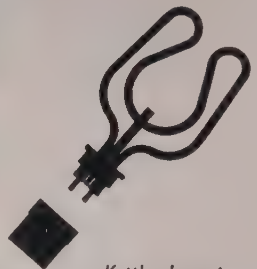


*Surgical sterilizer element with manual reset cut-out*



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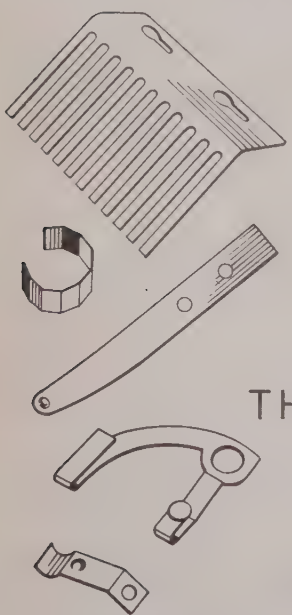

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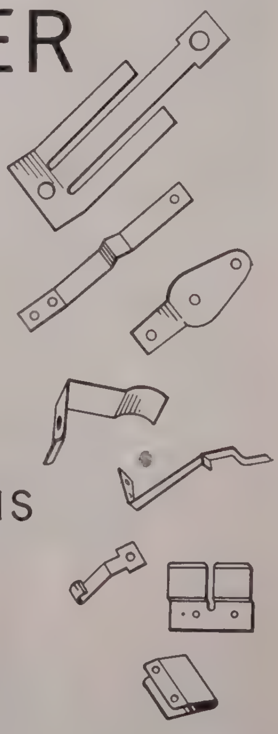

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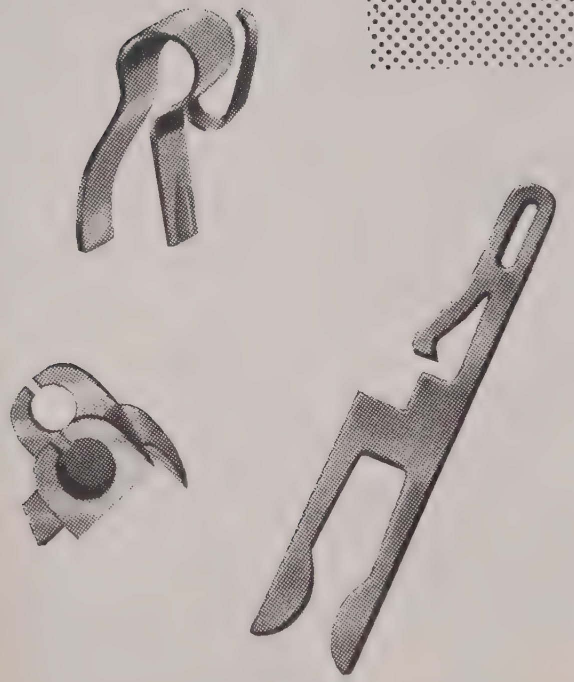

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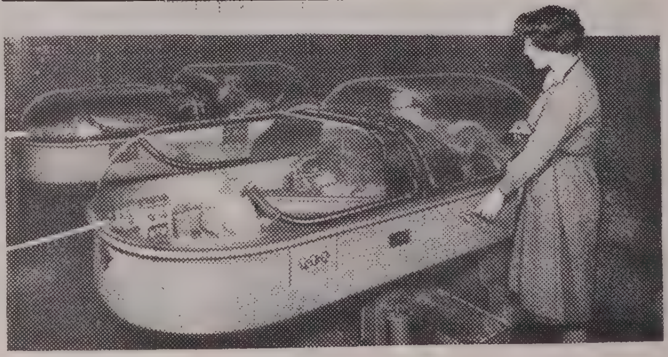

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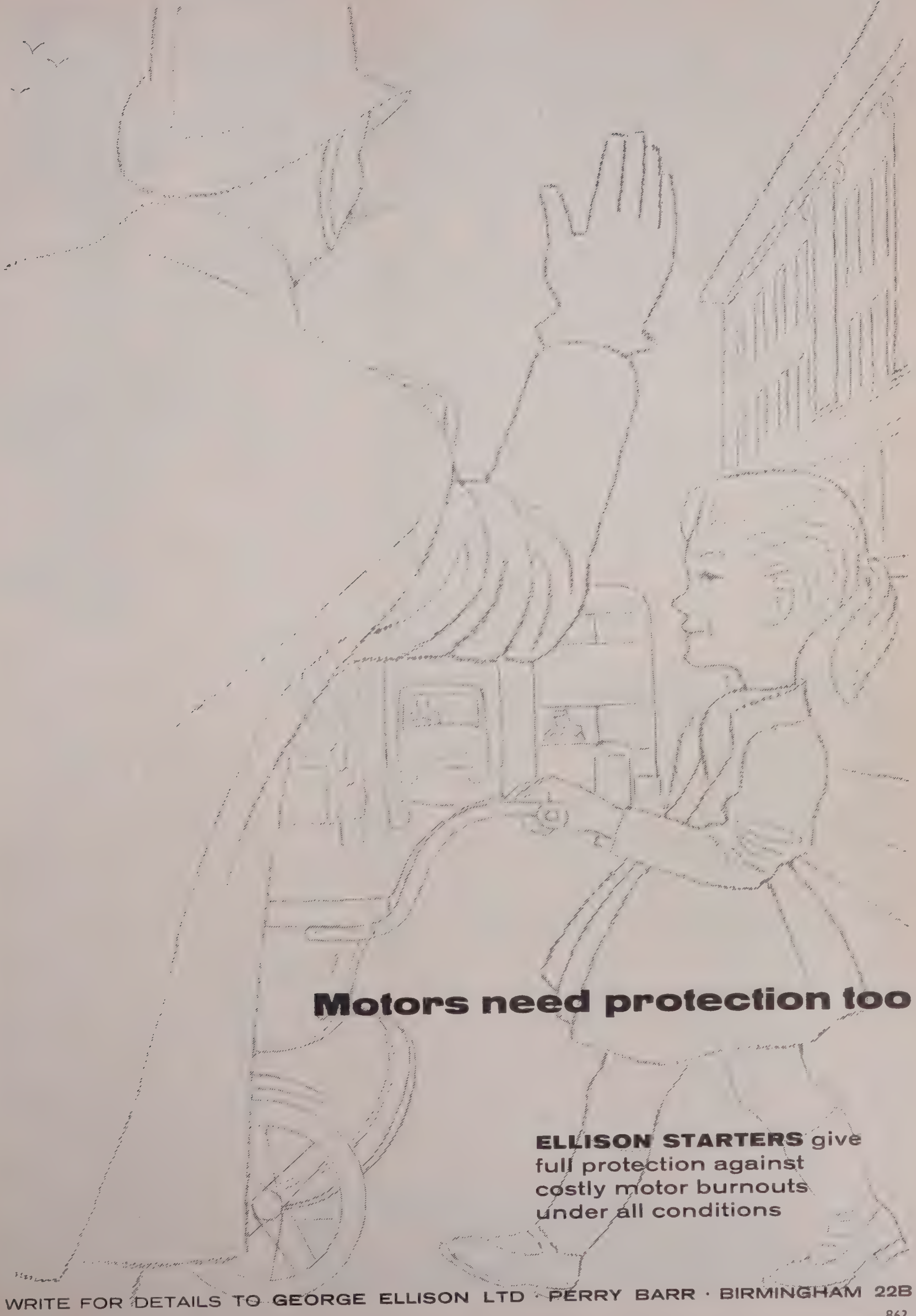

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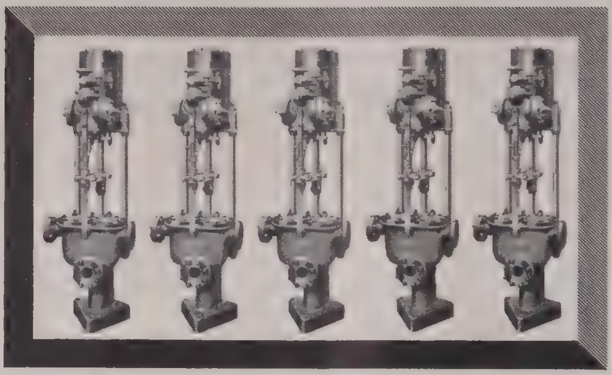

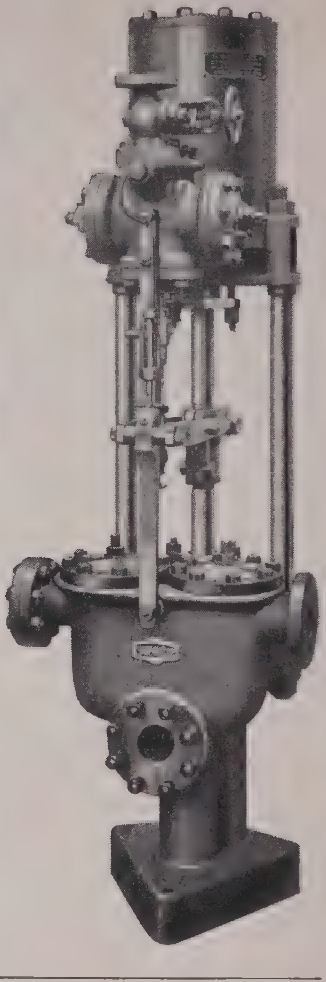

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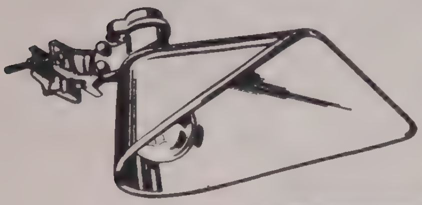

**List No. 890**
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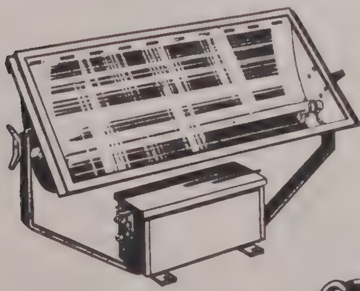
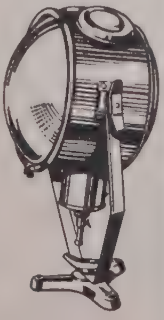
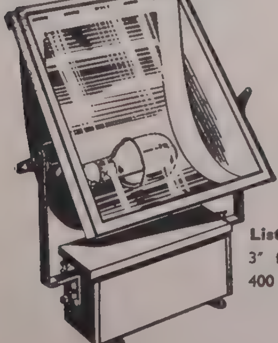


**List No. 942**
Upward lighting Lantern for 200 watt Sodium lamp.



**List No. 556**
Narrow beam Projectors for 500 watt to 1,500 watt G.L.S. lamps.



**List No. 1231**
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*are the quickest most convenient most versatile most economical cable securing method yet available*

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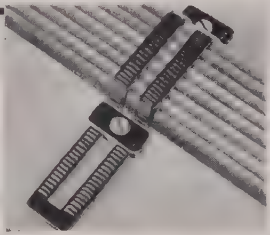
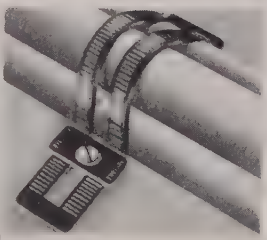
**2 point 2 screw fixing**

The quickest most convenient, most versatile and economical Cable securing method yet available. Designed specially for wall and panel mounted wiring installations, the AS Cable Saddle will accommodate cables of any diameter, type or combination, providing complete security with the highest insulation and anti-corrosive qualities in any climatic conditions. Only 3 sizes are required to cover the most complex cable assembly.

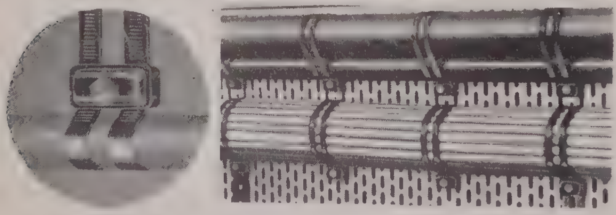




## Type SAS

**2 point single screw fixing**

Developed from type AS above, but specially adapted for use with standard cable racking. The type SAS Cable Saddles will efficiently secure with a single screw, cables of any diameter or diameters in even less time than ever before. Only two sizes are required to cover all requirements.



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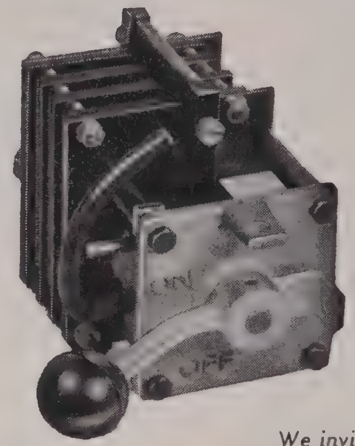

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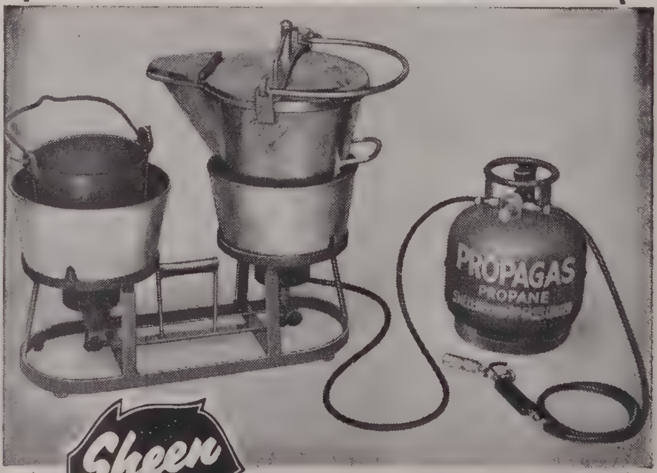

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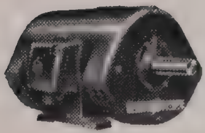

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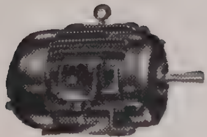

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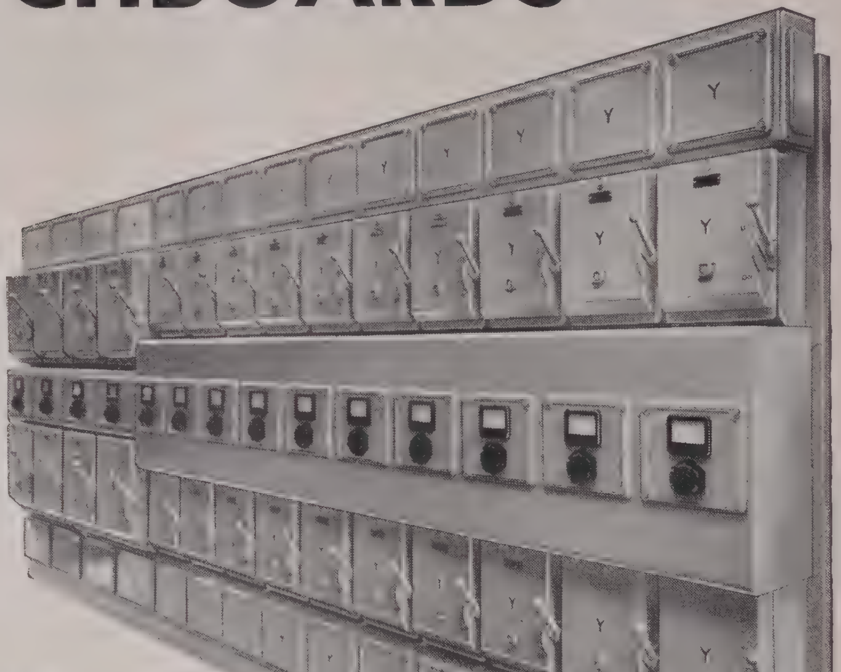
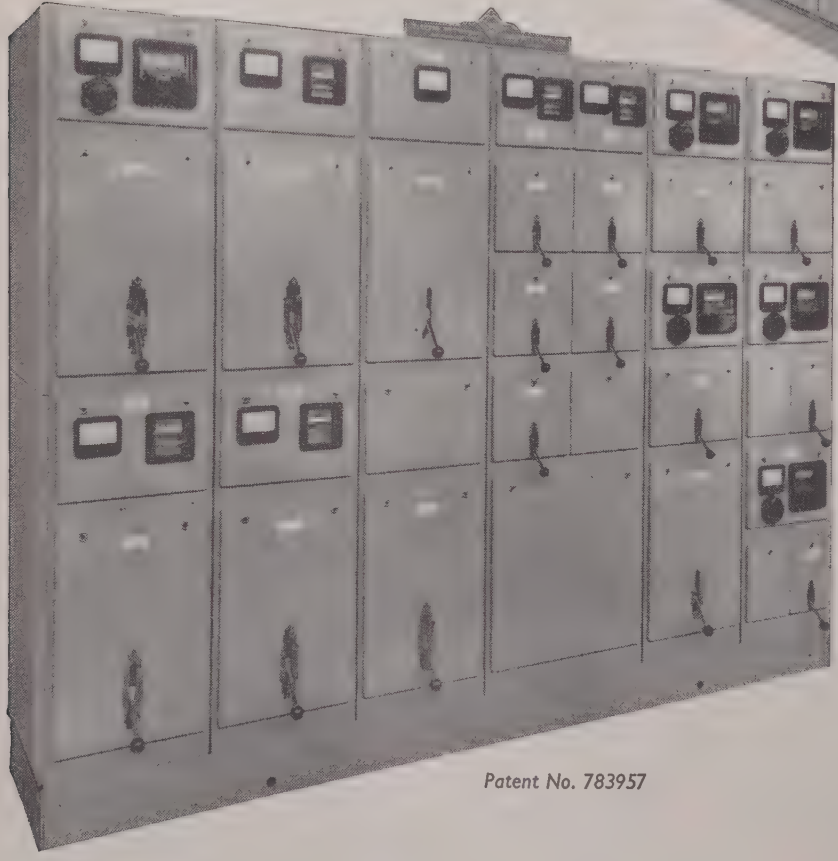
*Illustration below shows an indoor all-isolating cubicle construction switchboard having individual metering on the outgoing fused switches of 60 amp, 160 amp and 300 amp capacity.*





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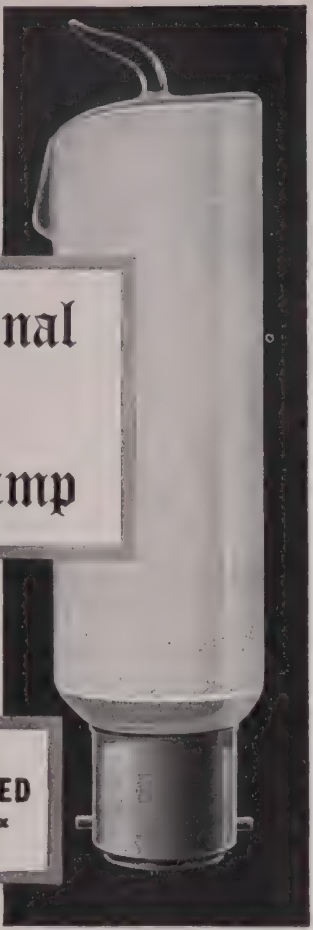

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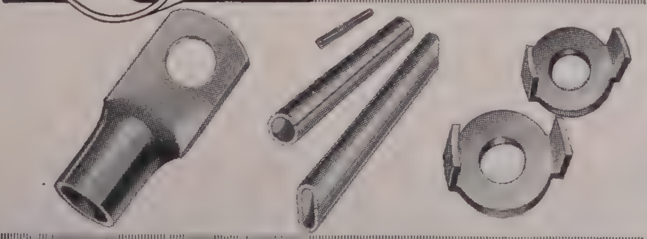

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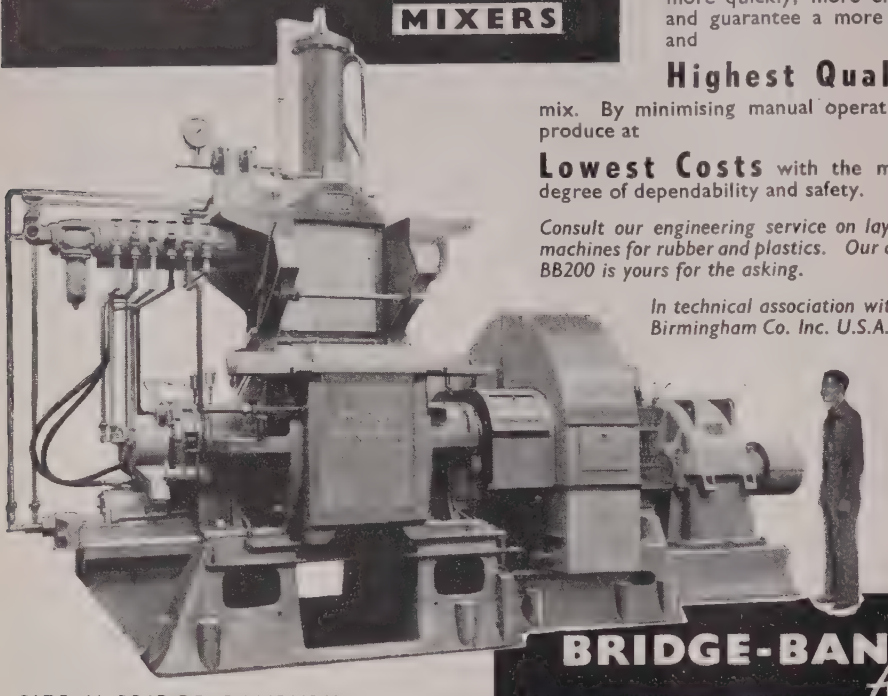

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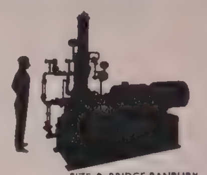

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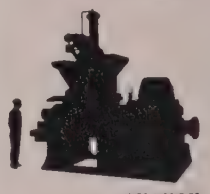

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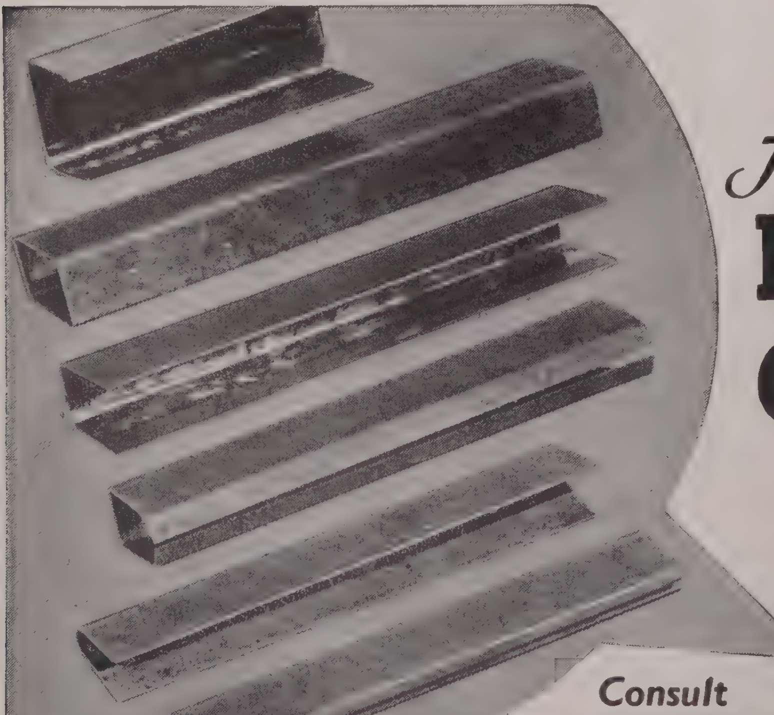

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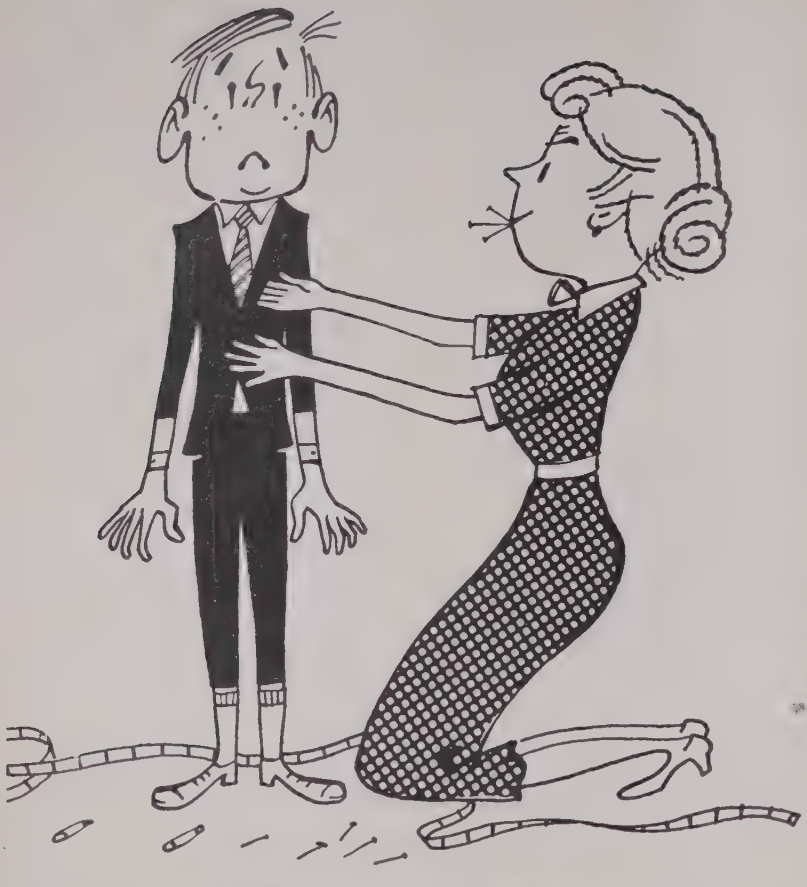

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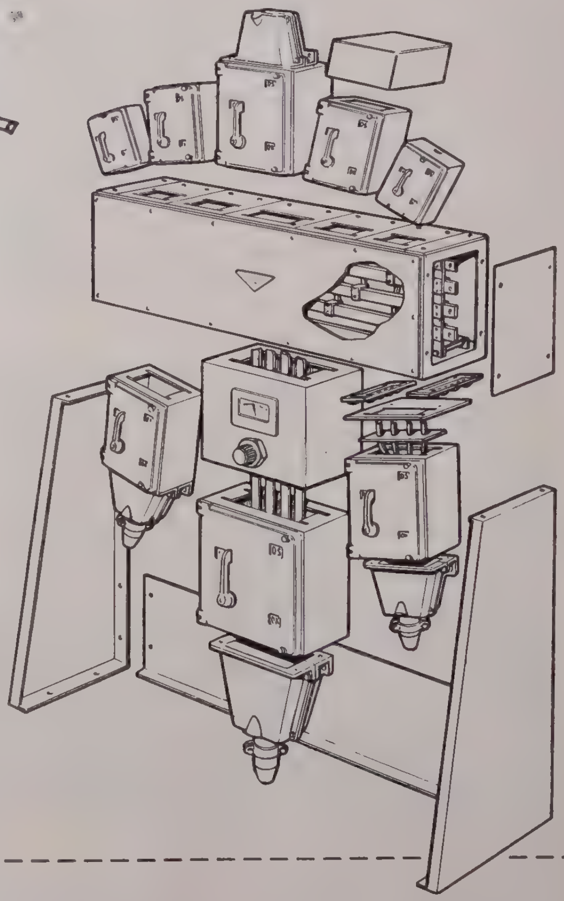

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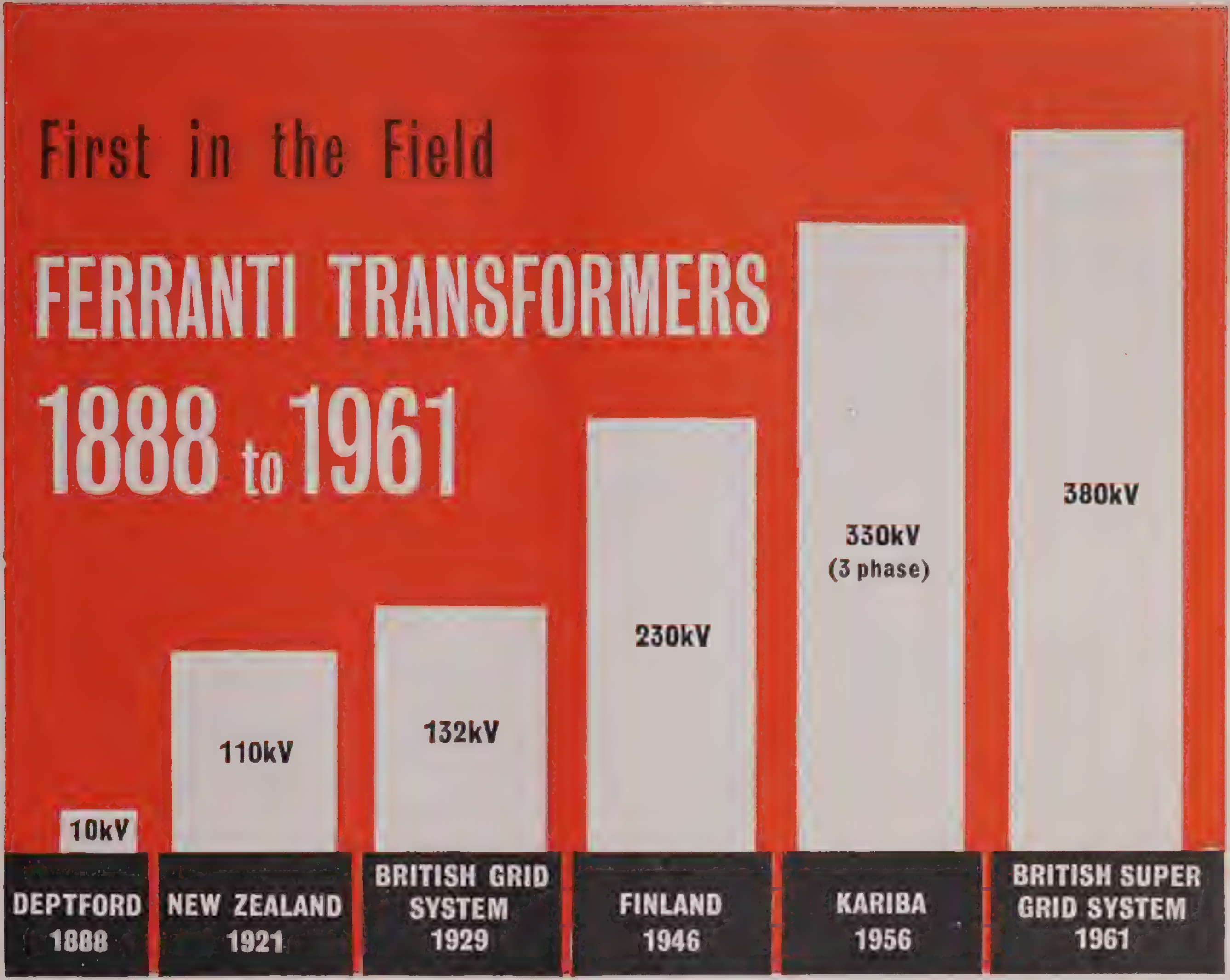

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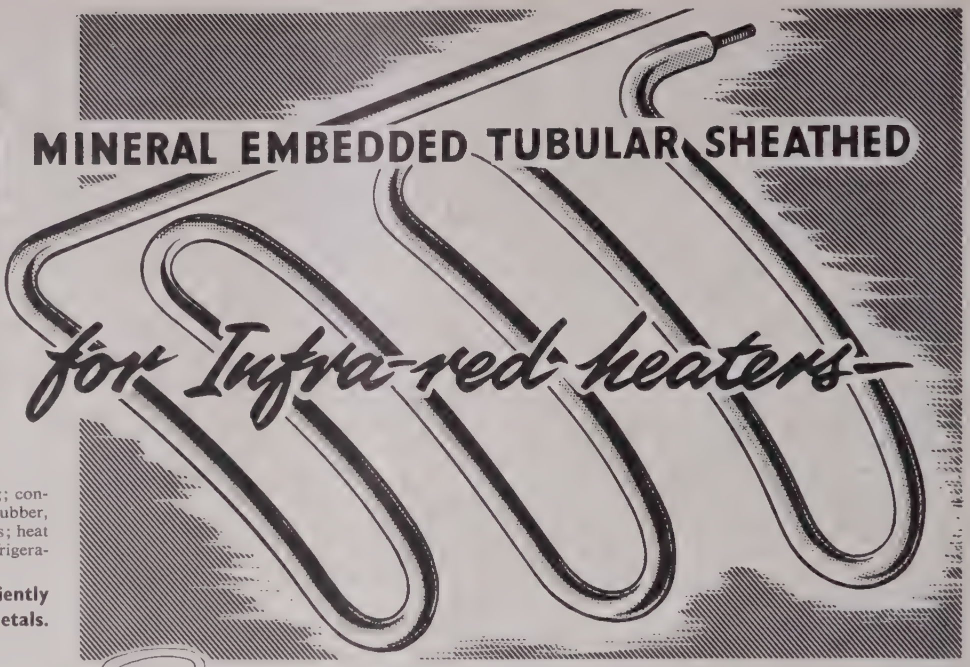

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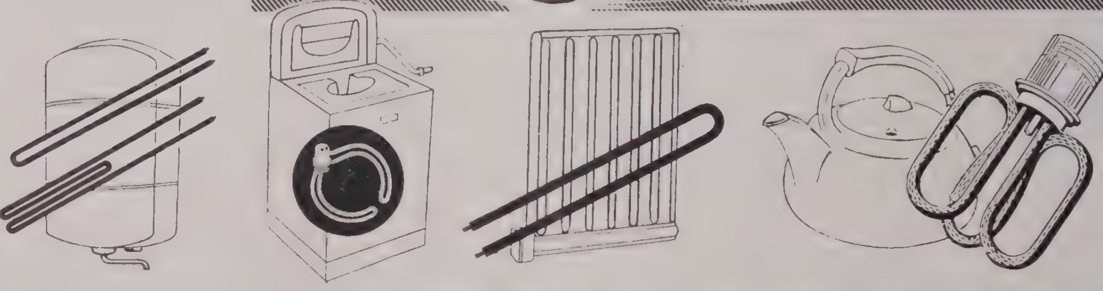

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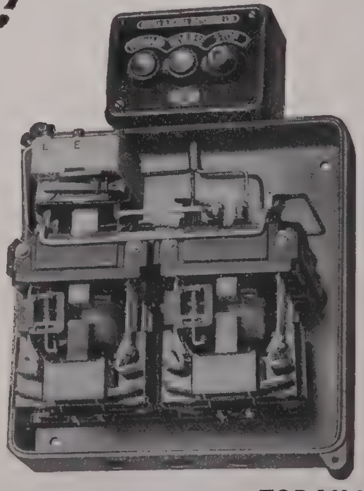

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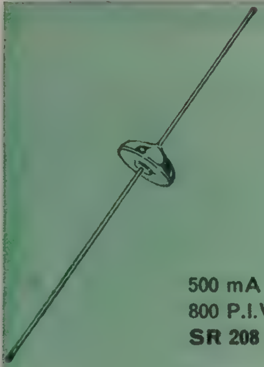
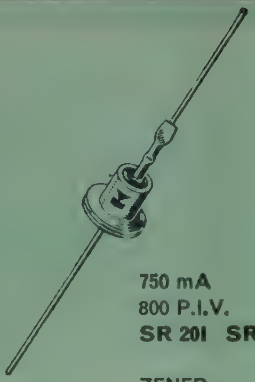


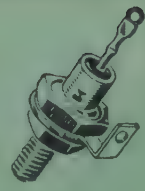
500 mA
800 P.I.V.
**SR 208 K**

ZENER
½ & 1 watt
**SR 257**



750 mA
800 P.I.V.
**SR 201 SR 202**

ZENER
¼ watt
**SR 251 A**



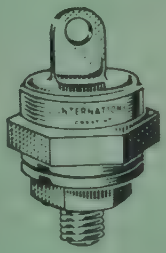
12 Amps
500 P.I.V.
**SR 308**

ZENER
10 watts
**SR 252 B**

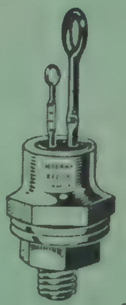
## HIGH POWER DIODES

250 Amps
600 P.I.V.
**SR 305 A**

*½ Full size*



45 Amps
600 P.I.V.
**SR 304 B**
**SR 310**



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Rectifiers
10 and 16 Amps
**XSR 350 A**
**XSR 351**

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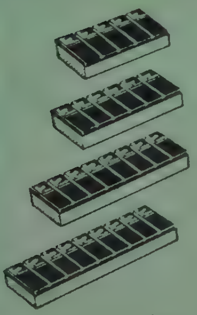

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Readout Cells
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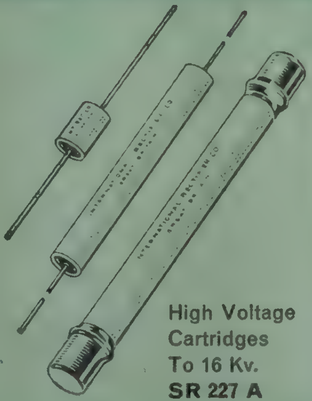

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To 16 Kv.
**SR 227 A**
**SR 225 B**
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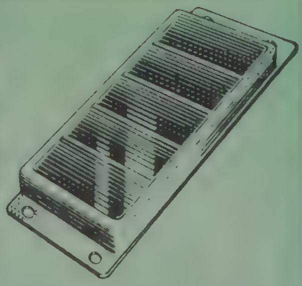

Solar Cells
**SR 276**

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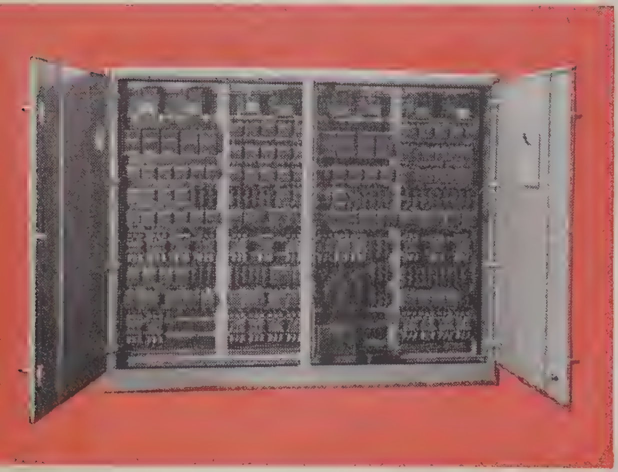

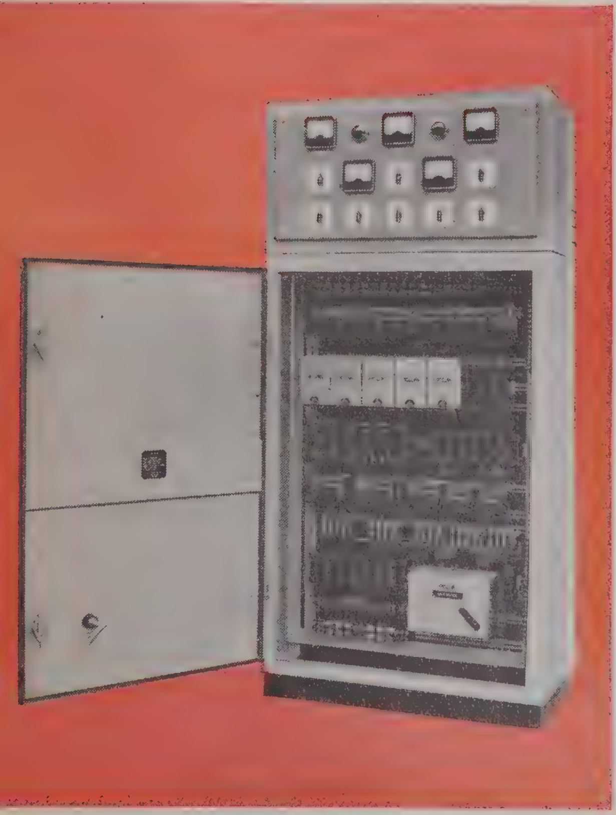

If ever there was a case of "no set answer" it is in the field of automatic controls.

You may require custom-built control panels, or you may prefer to build up your own control systems from individual M.T.E. components, chanel framework and standard cabinets.

Whichever way you look at it, you'll find that M.T.E. 'double-service' is the answer.

Top left:
Control panel for eight-head rotary indexing machine.

Lower left:
Control panel for industrial refrigeration plant.

**MTE 'DOUBLE-SERVICE'**

**M.T.E. CONTROL GEAR LIMITED**

# you look at it

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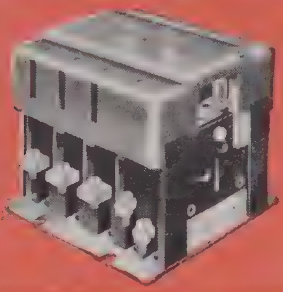

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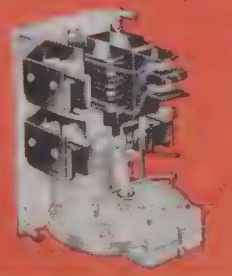

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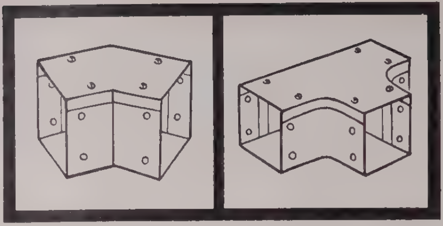

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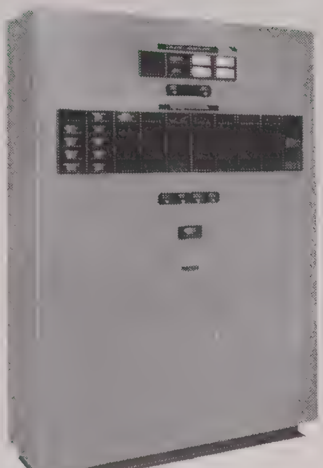

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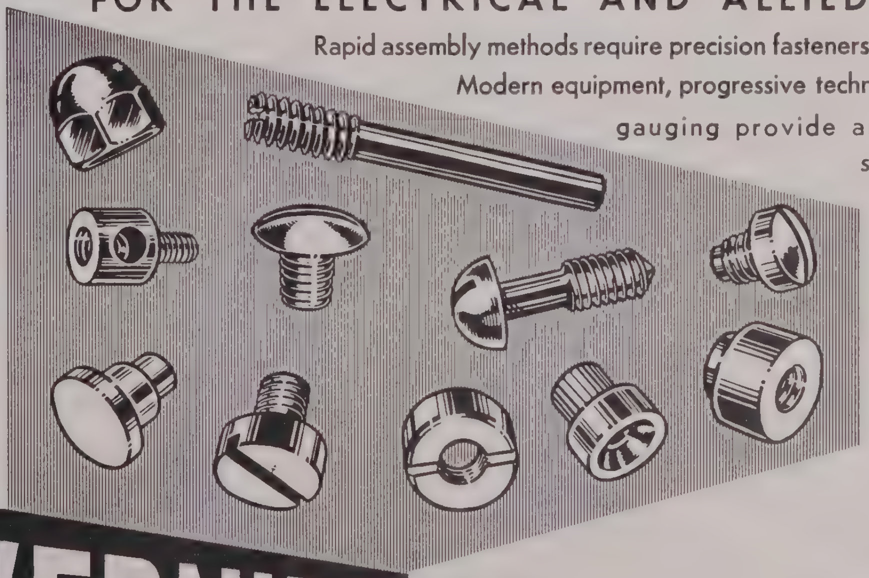

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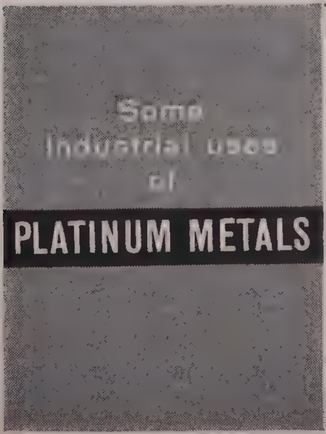
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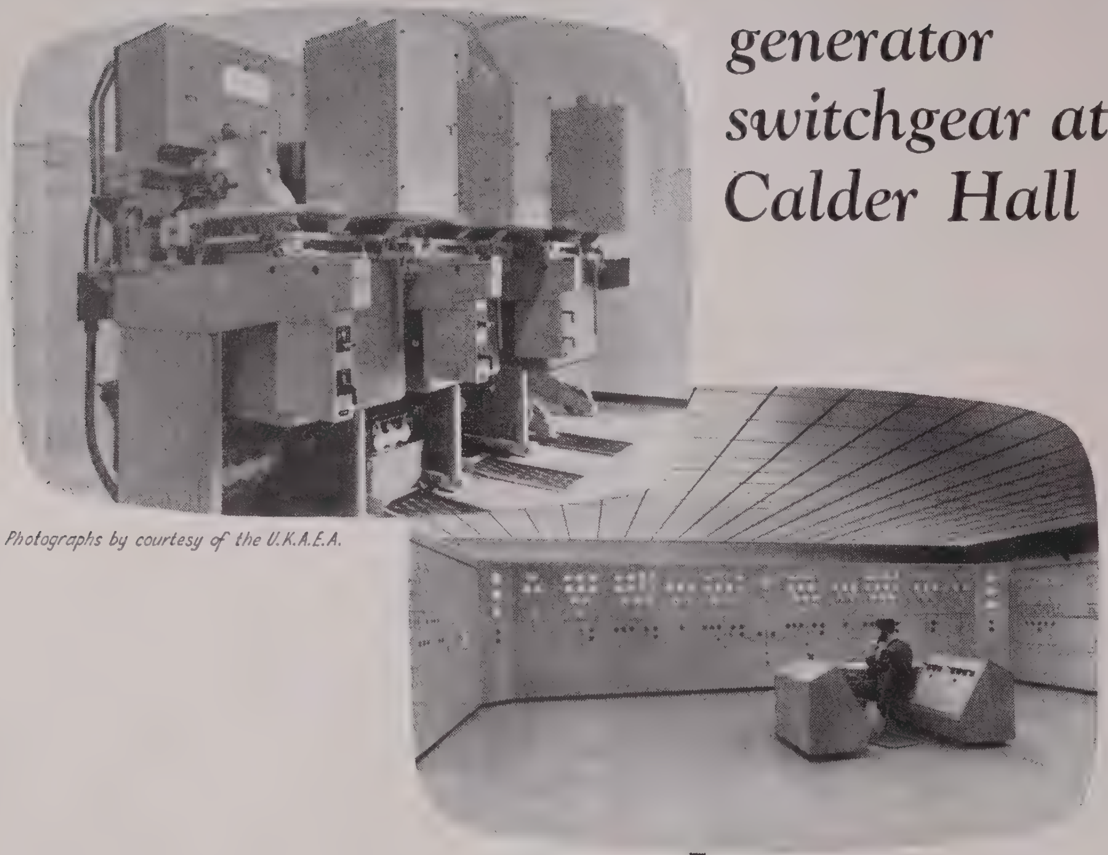

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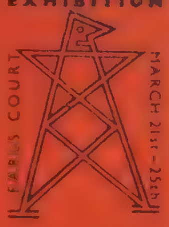

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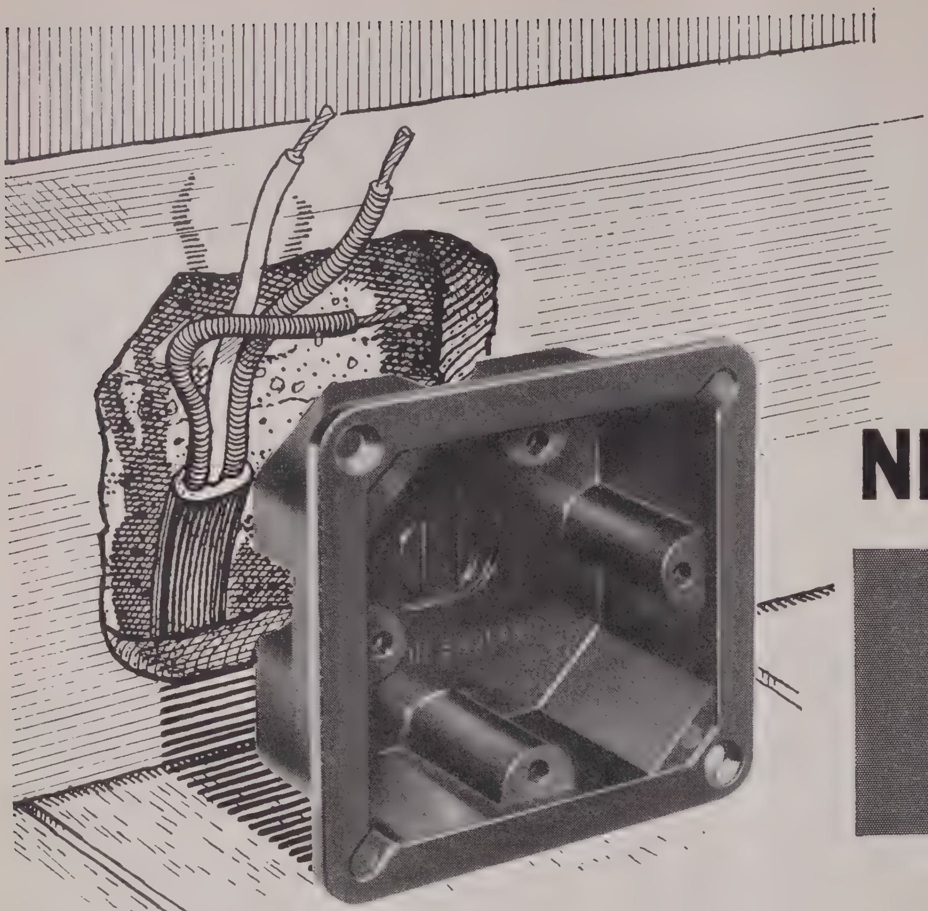

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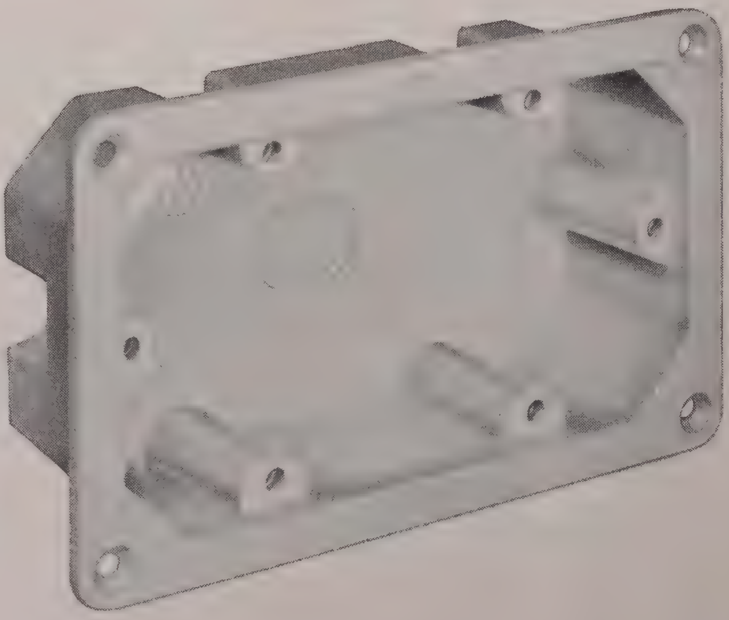

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# ELECTRICAL REVIEW

**Friday 10 February 1961 Volume 168 No 6**

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*Managing Editor:*
HUGH S. POCOCK, M.I.E.E.

*General Editor:*
J. H. COSENS

*Technical Editor:*
A. R. POLLARD, A.M.I.E.E.

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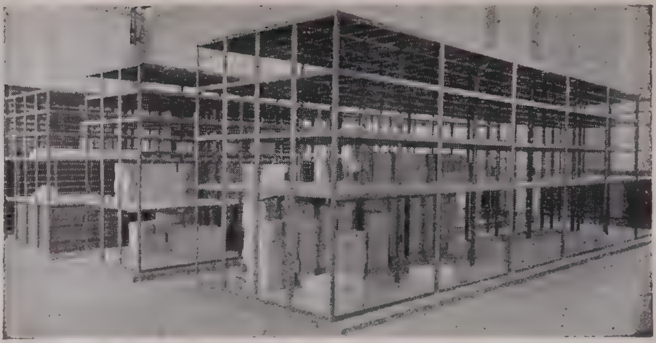

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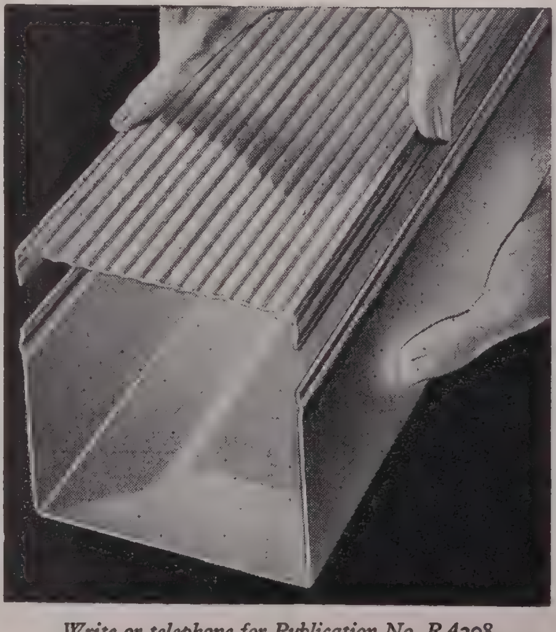

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ELECTRICAL REVIEW

10 February 1961 Vol. 168 No. 6 Established 1872

# *Engineers' Salaries*

THE results of a survey of chartered engineers' incomes in the financial year 1959-60 are analysed in the January issue of *The Professional Engineer*, the journal of the Engineers' Guild. There were 3,134 replies to the survey questionnaire, which was sent to a sample drawn from the lists of corporate members of the Institutions of Civil, Mechanical, Electrical and Chemical Engineers. The survey shows that the average salary for chartered electrical engineers was £1,584, which was higher than for civil or mechanical engineers, but lower than for chemical engineers. This general average salary would be attained by the average engineer at the age of about 40.

Comparing the results of this survey with those given in the Pilkington report on doctors' and dentists' and other professional men's salaries in 1955-56, the general level of engineers' salaries seems to have increased by about 25 per cent since then. The Engineers' Guild judges from this that the engineers' " ration has been stepped up." This would be true only if there had been no similar increase in the salary levels of other professions. In fact, we doubt whether the engineers' position at the bottom of the professional salary table has been altered.

Pursuing this theme, however, the Guild says that " voices are heard inquiring whether the bird [engineer] is getting greedy and will price itself out of the market." How can this be so when, in comparison, the engineer is underpaid and yet requires no less training and no less ability than any other professional man. It is only by trading on the interesting nature of the work that some employers have recruited sufficient staff at low salaries. The " rise " to £30 per week at 40 cannot be said to provide much incentive. It is not particularly encouraging to the young engineer who, after spending six years in training, also has a growing family to support. " Some jobs," says the Guild, " may be found not to bear the increase, and the general answer will be that these ought not to be held by qualified engineers at all." This is begging the question, particularly as some commercial jobs carry more salary and less responsibility than those also involving technical duties.

The product of most manual workers' labours is self-evident and is relatively unaffected by environment. The professional engineer applies his knowledge and experience, but his present salary level does not allow him to carry his responsibilities free from the more basic material worries. Thus, as an employee, he becomes preoccupied and uninterested, while the employer does not obtain the full benefit of his trained mind. We are not in favour of continued pay rise demands by any form of trade union, but we think that the difficulty would be solved if the professional status of the engineer were accepted by the public. This seems, however, to be a problem for the institutions.

The public is still confused by the present multitude of titles given to engineers by about twenty-five different institutions. This could be resolved by amalgamation into one engineering institution, but only half-hearted consideration is being given to this proposal (see the leader in our 16th December issue). However, a joint public relations department has been suggested as a first step and we would welcome this.

Individual qualifications (and hence professional status) of chartered engineers could be raised by judicious alteration of the requirements for corporate membership. The salary survey shows that a university graduate's salary is as much as 50 per cent higher than that of a non-graduate engineer. This might be claimed to be a vindication of the policy of the senior institutions in making it more difficult for non-graduates to become corporate members.

## COAL AND POWER POLICY

During the past few years we have constantly stressed that it is futile to try to found a power policy upon the ever-changing mood of the coal-mining industry. The original White Paper on nuclear power was produced at a time when the National Coal Board was unable to guarantee sufficient supplies to power stations for more than a decade or two. At the same time, to bridge the gap, the then Central Electricity Authority was urged to convert some of its coal-fired stations to oil fuel and even to erect oil-burning stations. Within a fairly short time we were told that supplies of coal had become ampler and that unless consumption was raised the National Coal Board would be left with embarrassing surpluses. Thereupon the C.E.A. was directed to cease its extension of the use of oil fuel and the nuclear power programme was retarded.

Now the scene is again changing. Last week a delegation from the Trades Union Congress met the Prime Minister to seek a Government guarantee of production—200 million tons a year—in order to arrest the decline in mining man-power. Mr. Macmillan refused to give such a guarantee, and indeed it is difficult to see how the Government could force industry to consume coal instead of possibly cheaper or more convenient fuels. On the following day, in the House of Commons, Mr. J. B. Eden moved a resolution urging the Government to maintain the nuclear power programme at a level that would encourage the development of manufacturing experience and capacity, and provide the best possible prospects for exporting British designs, products and skill. The motion was agreed to after Mr. J. C. George, Parliamentary Secretary to the Ministry of Power, had expressed the view that the present programme was sufficient to sustain the industry.

**Electrical Manufacture in Europe**

Next week we shall be beginning a new series of articles on this subject with an account of progress in Western Germany. The series is introduced by Mr. S. F. Steward, director of the B.E.A.M.A., and future articles will cover all the countries of the "Six" and the "Seven"

## SPACE COMMUNICATIONS

Whatever one's views on the priority that should be given to capital expenditure on a British space programme, it is clearly important that research workers and manufacturers in this country should not be deprived of reasonable opportunities for gaining experience in the new techniques. One of the most attractive lines of development is the possibility of improving and extending world communication networks by the use of satellites. But there is a large gap between the present stage when such communication has been proved feasible and the realisation of an economic and reliable system. Experience should have taught this country that all the benefit does not lie with the pioneer.

Talk of the "development and exploitation of space for commercial purposes" and of "a new Eldorado" appear premature and misleading. The immediate task of the newly-formed British Space Development Company, reported on page 257, will be to represent a cross-section of industry in talks that may follow the Government's attempts to obtain European and Commonwealth participation in a joint space programme. Since communication via space satellites will require international regulation and agreement, there is every advantage in seeking the fullest technical co-operation at the outset. The benefits from this may be no less than from the ultimate improvement in communications.

## RELIABLE REACTORS

One of the reactors at Calder Hall was in continuous operation during the year ended 31st January last and for 95·6 per cent of the time it was operating at full load. The period when it was not on full load was accounted for by scheduled maintenance (0·7 per cent) and experimental work (2·7 per cent), while unscheduled maintenance accounted for only 85 hours (1 per cent).

No fuel element failure occurred during the year, but the reactor is now shut down for routine maintenance and change of fuel. This operating experience is an indication of the reliability of magnox reactors and is a good augury for the first two "civil" stations, Berkeley and Bradwell, which are due to go on load in the autumn.

# Cross-Bonding Single-Core Power Cables

By D. J. CLARKE, A.M.I.E.E.,* and I. P. SETH, A.M.I.E.E.†

**This article gives a general account of the potentialities of power cable installations with cross-bonded sheaths and of the means by which sheath voltages can be predicted and controlled. Details are given of the first installation to be commissioned in London employing cross-bonding and of the tests carried out to confirm the effectiveness of the design by measuring the actual sheath potentials and circulating currents under various load conditions**

THE growth of generating and transmission systems in Great Britain is bringing a demand for underground cables with carrying capacities considerably higher than have been commonly required in the past. There are therefore strong practical and economic incentives to the adoption of installation methods whereby sheath power losses (with their heating effects) in single-core cables can be virtually eliminated, thus permitting an increased current rating for a given conductor size as compared with the conventional trefoil formation with solidly bonded sheaths.

It has long been obvious that the power losses associated with circulating currents in the sheaths of single-core cables must adversely affect their current-carrying capacity. In Great Britain, however, and in fact most countries other than the U.S.A. and Canada, loading requirements have been relatively modest, and until recently the largest load capacity required of 132 kV cables has been around 120 MVA. Such ratings can be achieved economically either by using three-core cables or conventionally arranged single-core cables. In solidly bonded lead-sheathed single-core cables the sheath losses are not unduly severe provided that the current is modest and the cables are grouped in close trefoil formation.

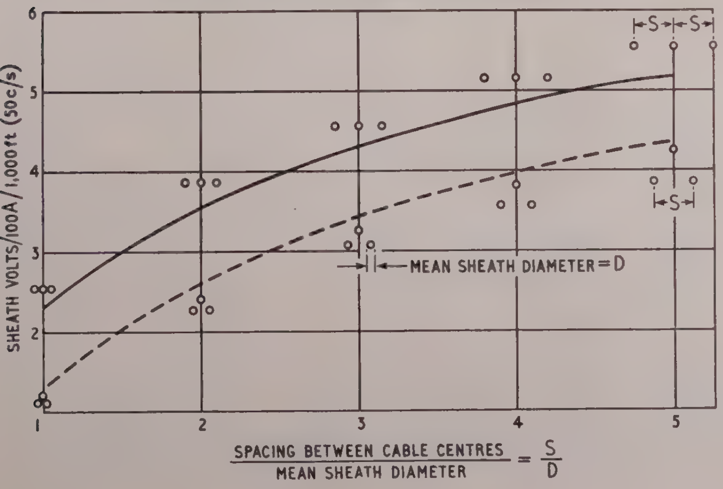
TABLE I

Continuous ratings of single-core hollow conductor 132 kV oil-filled cables laid direct in the ground. Soil thermal resistivity 120°C.cm/W, soil temperature 15°C, conductor temperature 85°C, depth of laying 42in to top of cable

| Conductor Size (sq in) | 0·40 | 0·60 | 1·00 |
|---|---|---|---|
| | Amps (MVA) | Amps (MVA) | Amps (MVA) |
| *Solidly Bonded* | | | |
| Close trefoil ... ... ... | 495 (113) | 595 (136) | 745 (170) |
| Sheath losses as % of conductor losses ... ... | 7% | 10% | 18% |
| *Cross Bonded* | | | |
| Close trefoil ... ... ... | 510 (116) | 620 (141) | 790 (180) |
| Flat touching ... ... | 520 (118) | 645 (147) | 835 (190) |
| Flat 6in centres ... ... | 555 (126) | 690 (158) | 910 (207) |
| Flat 12in centres ... ... | 590 (134) | 735 (168) | 975 (222) |
| Sheath losses as % of conductor losses ... ... | negligible for all formations (eddy current losses only) | | |

Operation with cross-bonded sheaths permits an increase in cable current rating to a greater extent than may be immediately apparent. Two factors which result in an increased rating arise:—(a) a reduction of sheath heating by using cross-bonding, and (b) a reduction of mutual heating due to the wider spacing of the single-core cables. With solidly bonded sheaths, the rating is adversely affected by increased spacing of the phase cables as the better heat dissipation is negatived by the resultant increase in induced sheath voltages bringing about higher sheath circulating currents and sheath losses.

*Fig. 1.—The relationship between sheath voltage and cable spacing for insulated sheath single-core cables. For frequencies other than 50 c/s, voltages shown must be in direct proportion to frequency*



The considerable improvement in cable current ratings which stems from the elimination of sheath circulating currents is illustrated in Table 1 where, for example, it can be seen that the rating of a 0·6 sq in single-core oil-filled cable is increased by about 8·5 per cent when the cables are cross-bonded and laid flat, touching. The

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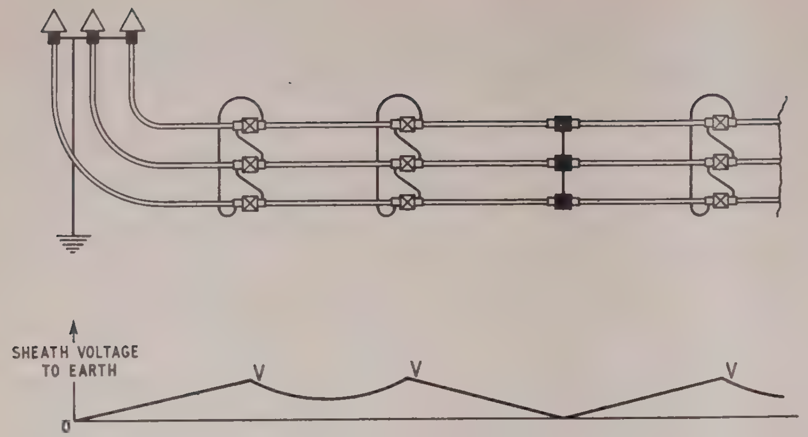
* British Insulated Callender's Cables, Ltd.
† Central Electricity Generating Board.



*Left: Fig. 2.—Kirke-Searing bonding, showing the sheath voltage to earth*

*Below: Fig. 3.—Typical sheath voltage vector diagrams: (a) cables laid in trefoil formation ; (b) cables laid in horizontal flat formation*

increase is about 24 per cent when the spacing is 12in between cable centres.

## Induced Sheath Voltages

When single-core cables carry alternating current, voltages of power frequency are induced in the metallic sheaths due to the mutual inductance between core and sheath and the mutual inductance with other cables in the group. These voltages are directly proportional to the frequency, the conductor current and to the length of sheath. They are also functions of the spacing between cable centres, the circuit configuration, the ratio between inner and outer sheath diameters and the currents flowing in adjacent cables.

The value of the sheath voltage $E_s$ is given by the formula:—$E_s = I_c X_m$, where $E_s$ is the induced sheath voltage, $I_c$ is the conductor current, and $X_m$ is the mutual reactance between conductor and sheath. For a frequency of 50 c/s this is given in ohms per 1,000ft by:—

$$0{\cdot}0193\left(A+K+\sum_{2}^{n}\left[\left(\log_e \frac{Sak}{Sa(k-1)}\right)\sum_{1}^{n-1}\frac{Ik}{Ia}\right]\right)$$

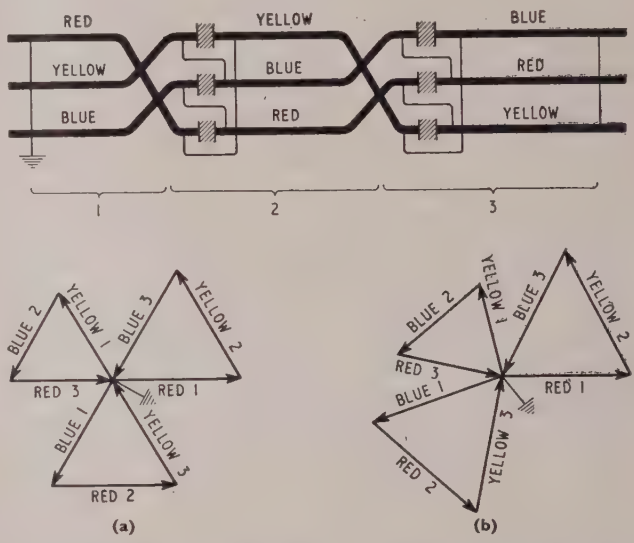
$$\text{where } A=\log_e \frac{2S}{D_2}$$

$$K=\tfrac{1}{2}-\left(\frac{1}{\left(\frac{D_2}{D_1}\right)^2-1}\right)\log_e \frac{D_2}{D_1}$$

S =Distance between cable centres
$D_2$ =Outside diameter of cable sheath
$D_1$ =Inside diameter of cable sheath
Sak =Distance between centres of cables a and k
Sa (k−1)=Distance between centres of cables a and (k−1)
n =Number of cables in group
Ik =Current in cable k
Ia =Current in cable a

Since I is expressed in vector form the summation term will be complex and can be written B+jC.

For a single circuit laid in trefoil formation, B and C=0 for all cables. With cables laid in flat formation the value for the centre cable will be zero, whilst the two outers will be 0·346±j 0·6. Where more than one circuit is involved, different values will be obtained depending upon the distance between circuits and the phase relationship between the various conductor currents. For cables laid flat or in trefoil formation, the numerical value of $E_s$ can be readily obtained for a single circuit from the curves shown in Fig. 1. For most practical purposes, this graph will give sufficient information to enable a ready assessment to be made of the maximum sheath voltage to earth likely to occur under normal service conditions.



## Cross-bonding in Practice

The prevention of sheath circulating currents can be achieved by bonding and earthing the sheaths at a single position on the cable circuit. When, however, the circuit length (and thus the sheath standing voltage) is too great to permit single-point bonding, either in the centre or at the end of the route, there are a number of ways in which sheath potentials can be kept within specified limits. In making the choice of method, the following considerations must be borne in mind:—(a) Sheath losses must be negligible, (b) the sheath standing voltage must be kept within prescribed limits, (c) transient voltages should not be great enough to damage sheath insulations, (d) losses in bonding equipment must be the minimum, (e) harmful harmonic currents or voltages should not be introduced into the system, and (f) the cost of cross-bonding must be economic in comparison with other installation methods.

The requirements listed can best be met in practice by the Kirke-Searing method of solidly bonding the sheaths at each third joint position and cross-bonding at the two intermediate joint positions as shown in Fig. 2. If cable spacing and section lengths are constant, then the induced voltages in each section length will be approximately equal. With cables in flat formation, the sheath voltages induced in the two outer cables are slightly higher than that

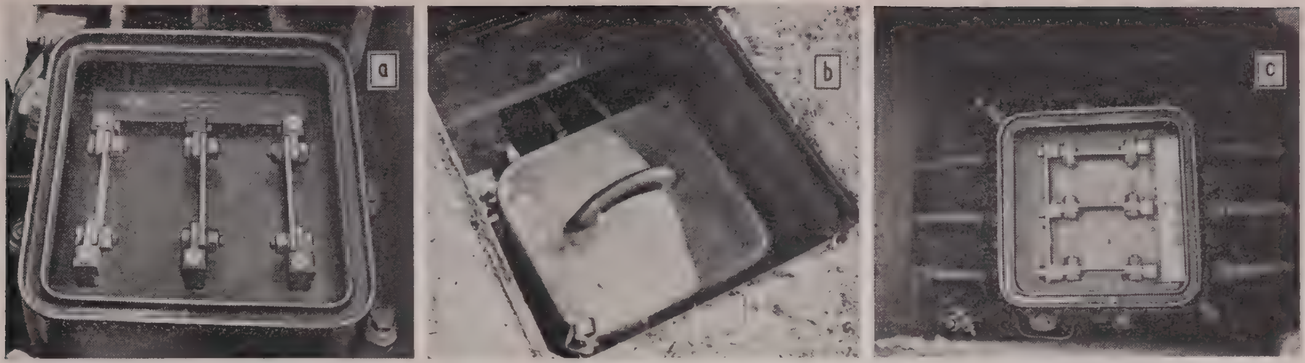


*Fig. 4.—Surface link boxes for sheath bonding, showing (a) link box at cross-bond position, (b) link box with cover in position and (c) link box at solid bond position*

induced in the sheath of the centre cable. This effect is overcome by the normal transposition of the cables at each joint bay. With equal section lengths and spacings, the induced voltages in each component section of each sheath circuit are equal since in any one series circuit all three sheaths occupy, in turn, the same relative position in the cable formation. The vector sum of the induced voltages in any one series sheath circuit must then be zero and hence, at each third joint at which the sheaths are solidly bonded, there is no residual voltage to drive current through the sheath circuits.

In Great Britain it is usual to earth the cable sheaths at each end of the installation. It is sometimes advocated that the sheath should be earthed at each third joint (i.e. at solid bonding positions). In a properly designed system, however, there would not appear to be any great advantage in doing this, since at each third joint position, the sheaths return to earth potential as a result of the vector addition of the induced voltages. The effect of sheath surge voltages may, however, modify this conclusion. A vector diagram for a cross-bonded circuit is shown in Fig. 3.

At present, in view of limited service experience with cross-bonded systems, the maximum standing sheath potential is limited in Great Britain to 50 V. For most installations this does not impose undue restrictions on drum lengths; for 132 kV circuits lengths of approximately 700 yd can be utilised. With increased conductor currents a higher permissible sheath voltage may be necessary if section lengths are to be kept at their economic maximum. Experience has shown that transient voltages of several thousand volts may be induced as a result of switching and other system surges. The sheath insulation must be designed to meet this contingency.

Bonding between cable sheaths is carried out with insulated bonding leads. These can either be buried with the joint or brought out to the surface and connected in a link disconnecting box. By using surface link boxes, electrical access to the sheaths can be readily obtained to enable check serving tests to be carried out if required and to facilitate the location of any serving faults should these occur. Fig. 4 shows a surface link box of the type being used on current installations in the London area.

Because of the standing and transient sheath voltages, an essential feature of a cross-bonded circuit is the insulation from earth and from each other of the sheaths and accessories. Anti-corrosion protections currently used with pressure cables have good insulating properties. They usually incorporate a minimum of 40 mils of vulcanised rubber sandwiched between p.v.c. or cotton tapes or they consist of an extruded plastic oversheath. These servings are tough and durable and should retain good insulating qualities throughout the life of the cable. Insulation of the joint casing is achieved by enclosing the joint within a bitumen-filled p.v.c. sleeve as shown in Fig. 5. Insulation is completed by inserting insulating links in oil or gas feed pipes and by mounting the sealing ends on small post insulators in place of the teak battens

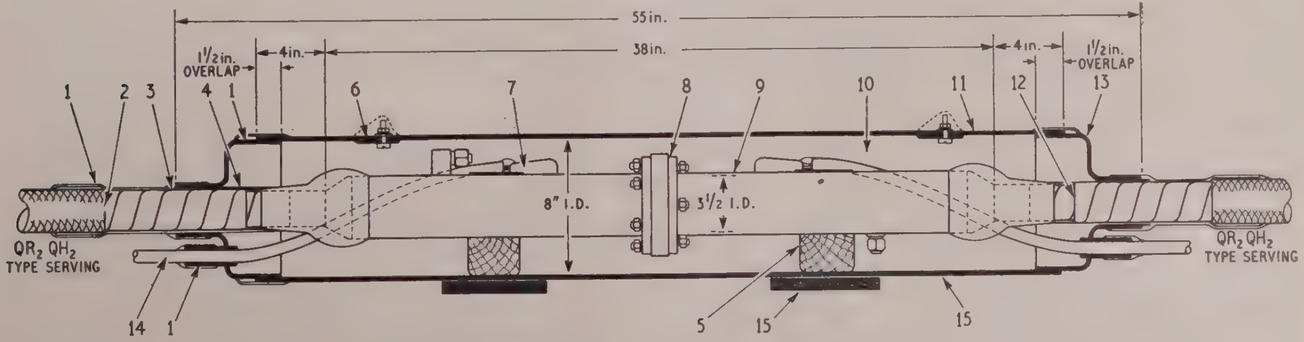


*Fig. 5.—Bitumen-filled p.v.c. sleeve used for joint insulation*

1. Layers of rubber tape with dry cotton tape overall, basted with compound after application. 2. Termination of outer serving. 3. Rubber tape built up to bore of p.v.c. gland. 4. Layers of rubber tape applied from wipe to a minimum of 3in past outer serving cut. 5. Wood support block. 6. Filling port with clamp type seal. 7. Bonding lug. 8. Layer of 2in wide rubber tape over flanges. 9. Outline of cable joint. 10. Filled with bituminous compound. 11. High-impact p.v.c. sleeve. 12. Termination of rubber and p.v.c. serving tapes. 13. High-impact p.v.c. end cap. 14. Bonding cable. 15. Concrete support with liner of salvaged serving or rubber tape

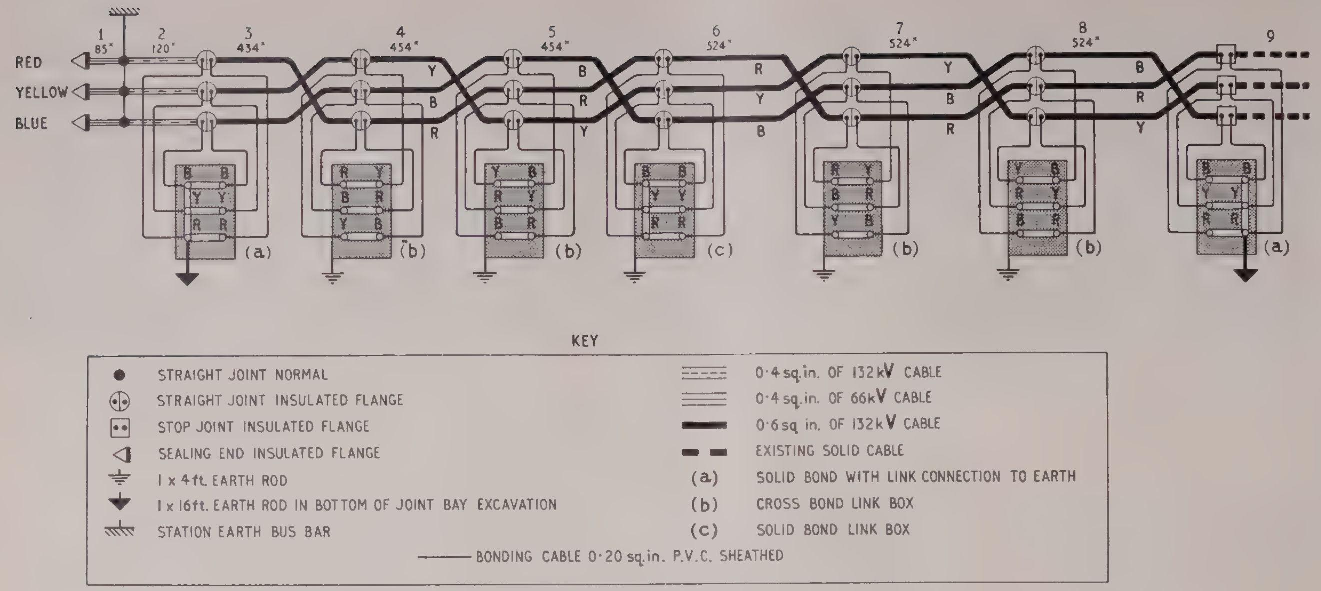

1 85"
2 120"
3 434"
4 454"
5 454"
6 524"
7 524"
8 524"
9
RED
YELLOW
BLUE
(a)
(b)
(b)
(c)
(b)
(b)
(a)
KEY
STRAIGHT JOINT NORMAL
STRAIGHT JOINT INSULATED FLANGE
STOP JOINT INSULATED FLANGE
SEALING END INSULATED FLANGE
1 x 4ft. EARTH ROD
1 x 16ft. EARTH ROD IN BOTTOM OF JOINT BAY EXCAVATION
STATION EARTH BUS BAR
0·4 sq.in. OF 132kV CABLE
0·4 sq.in. OF 66kV CABLE
0·6 sq. in. OF 132kV CABLE
EXISTING SOLID CABLE
(a) SOLID BOND WITH LINK CONNECTION TO EARTH
(b) CROSS BOND LINK BOX
(c) SOLID BOND LINK BOX
BONDING CABLE 0·20 sq.in. P.V.C. SHEATHED

*Fig. 6.—Bankside to Trafalgar Street bonding diagram*

commonly used in the past. After completion the installation is subjected to 10 kV d.c. between sheath and earth for one minute to check the soundness of the joint and sheath insulation.

## Recent Installations

Two of the first cross-bonded installations in this country were commissioned by the London Division of the Central Electricity Generating Board in 1959 and 1960. One of these consists of a double circuit of 132 kV gas pressure cable between Belvedere and Sydenham, a route length of nearly 12 miles. The cables were designed to carry 150 MVA on one circuit or 132 MVA each with both simultaneously loaded. The second installation is between Bankside power station and Trafalgar Street, Southwark, and turns an existing 66 kV feeder into Bankside power station. The contract involved a double circuit of 0·6 sq in 132 kV cable over a route approximately two miles in length. Although initially operating at 66 kV, the cables were designed for 132 kV to provide for future requirements. At 132 kV a continuous load of 132 MVA on each of the two circuits can be carried with both simultaneously loaded, or 150 MVA with one circuit loaded. With the cables installed in normal trefoil formation, and solidly bonded at each joint position and at the terminations, the conductor section required would have been 0·75 sq in. This demonstrates in a practical manner the economy in copper which can be effected on an installation of this nature. Fig. 6 shows diagrammatically the layout of the cables with cross-bonding connections.

At Bankside, the closing lengths, which are 66 kV oil-filled cable, are connected directly into switchgear using oil-immersed sealing ends fitted with insulating flanges to isolate the cable sheath from the switch tank metalwork. Cables between the power station and joint bay 2/3 are installed in air so that over this section it was possible to reduce the conductor size to 0·4 sq in with the sheaths solidly bonded and earthed. This ensured that, at positions accessible to personnel, sheath potentials would be negligible. Over the remainder of the route, however, the cable is laid direct and 0·6 sq in conductor has been used.

The cross-bonded portion of the scheme consists of six section lengths, three of approximately 440 yd and three of approximately 525 yd. Interruption of the sheath continuity was achieved at joint positions by using an insulating flange in the joint sleeve. Bonding connections were brought up from each side of the flange to the surface link box, using 0·2 sq in p.v.c.-sheathed conductor. Installation of the cables of each circuit was carried out in the normal manner except that they were laid in flat formation touching instead of in trefoil. A spacing of 18in was maintained between circuit cables. Mechanical protection is provided for the cables by reinforced concrete cover tiles overhanging the outer cables by a minimum of 2in. A typical cable trench cross-section is shown in Fig. 7.

## Cross-bonding Tests

Sheath voltage/conductor current tests were carried out on the cross-bonding on the Belvedere-Sydenham circuits, but the Bankside-Trafalgar Street installation, being relatively short, was considered particularly suitable for carrying out the more comprehensive tests described below.

On nearing completion of this installation, tests were

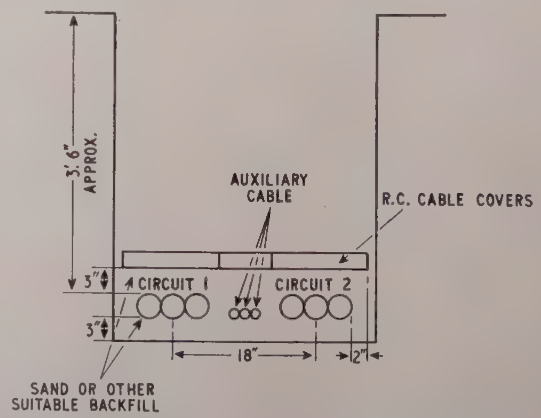


*Fig. 7.—Typical trench cross-section for cross-bonded installation*

carried out to determine the efficacy of the cross-bonding by simulation of actual service conditions. These tests were performed prior to jointing the new cable on to the existing circuit in Trafalgar Street. At the two joint positions in Trafalgar Street (joint bay 8/9) the oil-filled ends of the stop joints had been completed and the three conductors of each circuit connected solidly together by a copper shorting bar. Engineers stationed at each joint bay were equipped with voltmeters and tong ammeters to measure bonding lead voltages and currents. Communication with Bankside control room was maintained by radio and telephone.

Current was fed into the circuits by a 60 MW machine generating at low voltage. By raising or lowering the excitation, it was possible to adjust the load current to the test values required. At first it was feared that overheating of the generator turbine might occur due to the considerable periods for which light loads would be required, but no trouble was experienced and the generator remained stable throughout the whole testing period (approximately six hours). Since it was necessary to monopolise the use of the generator for a considerable period, the tests were performed at night. This had its advantage since some of the joint bays are in busy roads and traffic congestion and hazard to the engineers on site was therefore avoided.

The tests fell into three main groups:—(a) current and voltage readings in the Bankside-Battersea link boxes with various conductor currents, (b) current and voltage readings in the Bankside-Battersea link boxes with bonding errors introduced into one link box, and (c) current and voltage readings in all link boxes with both circuits simultaneously loaded.

Group (a) tests were carried out with conductor currents of 100, 250 and 500 A respectively, and were intended to determine the sheath currents and voltages under these conditions and to compare the results with those obtained by theoretical calculation. The sheath currents were measured by tong ammeters placed round the bonding leads between the joints and link boxes. Voltages were measured between the links and the earth rod in each link box pit. The results of the tests under group (a) are given in Table 2, together with the calculated voltage values. The two sets of figures compare very closely and it was found that less than 2 A flowed in the sheath circuit at 500 A conductor current. By comparison, in the 500 A test, the sheath current in the solidly bonded section of the route (the last two sections in Bankside power station) was approximately 55 A.

For the first test in group (b), incorrect connections were made in the link box at joint bay 3/4 by crossing the red-yellow and blue-red links to give red-red and blue-yellow links. It was found that this type of error, if previously undetected, would immediately be shown up by the voltage and current readings in that major section. The measured sheath current was approximately 7 per cent of the conductor current, which is a little less than would be obtained from a solidly bonded sheath circuit, whilst the maximum sheath voltage measured was about three times the value obtaining in the correctly connected cross-bonded system. These effects were limited to the major section into which the error was introduced.

Secondly, the effect of a broken bonding lead on the sheath voltages and currents was investigated. The red-yellow link at joint bay 3/4 was removed. The results of this test showed so little variation from those obtained with all links correctly connected (see Table 2) that it is clear it would not be possible to detect a broken lead in the system by voltage and current readings alone. Continuity checks would be the only positive detection method.

TABLE 2

RESULTS OF GROUP (A) VOLTAGE TESTS ON BANKSIDE/BATTERSEA FEEDER WITH CORRECT CROSS BONDING CONNECTIONS

| Voltmeter Readings taken at | | Bankside Battersea Feeder | | | | | |
|---|---|---|---|---|---|---|---|
| Joint Bay No. | Between | 100 A Conductor current | | 250 A Conductor current | | 500 A Conductor current | |
| | | Calc. volts | Meas. volts | Calc. volts | Meas. volts | Calc. volts | Meas. volts |
| 2/3 | All Links & Earth ... ... | ALL LINKS BONDED TO EARTH AT THIS JOINT BAY | | | | | |
| 3/4 | R–Y Link & Earth ... ... | 3·6 | 3·8 | 8·9 | 8·4 | 17·8 | 16·3 |
| | Y–B ,, ,, ,, ... ... ... | 2·4 | 3·3 | 6·0 | 6·2 | 11·9 | 11·5 |
| | B–R ,, ,, ,, ... ... ... | 3·6 | 3·8 | 9·0 | 9·2 | 17·9 | 18·2 |
| 4/5 | R–Y Link & Earth ... ... | 3·7 | 4·3 | 9·2 | 10·1 | 18·3 | 19·6 |
| | Y–B ,, ,, ,, ... ... ... | 3·6 | 4·3 | 9·0 | 10·2 | 18·0 | 20·0 |
| | B–R ,, ,, ,, ... ... ... | 2·4 | 3·2 | 6·1 | 7·6 | 12·2 | 14·6 |
| 5/6 | All Link & Earth ... ... ... | 0·13 | 0·0 | 0·3 | 0·0 | 0·7 | 0·6 |
| 6/7 | R–Y Link & Earth ... .. | 4·3 | 4·6 | 10·8 | 10·9 | 21·6 | 21·3 |
| | Y–B ,, ,, ,, ... ... ... | 2·9 | 3·1 | 7·2 | 8·4 | 14·4 | 15·4 |
| | B–R ,, ,, ,, ... ... ... | 4·3 | 4·5 | 10·8 | 10·9 | 21·6 | 22·0 |
| 7/8 | R–Y Link & Earth ... ... | 4·3 | 4·5 | 10·8 | 12·0 | 21·6 | 23·3 |
| | Y–B ,, ,, ,, ... ... ... | 4·3 | 4·5 | 10·8 | 12·0 | 21·6 | 23·3 |
| | B–R ,, ,, ,, ... ... ... | 2·9 | 3·0 | 7·2 | 7·5 | 14·4 | 17·1 |
| 8/9 | All Links & Earth ... ... | ALL LINKS BONDED TO EARTH AT THIS JOINT BAY | | | | | |

NOTE: Maximum sheath circulating current 1·8 A at 500 A conductor current.

TABLE 3

RESULTS OF VOLTAGE TESTS ON BANKSIDE/BATTERSEA AND BANKSIDE/DEPTFORD FEEDERS WITH BOTH CIRCUITS LOADED

| Voltmeter Reading taken at | | Bankside-Battersea Feeder 250 A Conductor Current | | Bankside-Deptford Feeder 250 A Conductor Current | |
|---|---|---|---|---|---|
| Joint Bay No. | Between | Calc. volts | Meas. volts | Calc. volts | Meas. volts |
| 2/3 | All Links & Earth ... ... ... | ALL LINKS BONDED TO EARTH AT THIS JOINT BAY | | | |
| 3/4 | R–Y Link & Earth ... ... ... | 7·2 | 5·7 | 10·3 | 10·1 |
| | Y–B ,, ,, ,, ... ... ... | 6·1 | 6·2 | 6·1 | 6·6 |
| | B–R ,, ,, ,, ... ... ... | 10·3 | 10·1 | 7·1 | 6·9 |
| 4/5 | R–Y Link & Earth ... ... ... | 10·6 | 10·3 | 7·4 | 7·7 |
| | Y–B ,, ,, ,, ... ... ... | 7·3 | 8·0 | 10·5 | 10·2 |
| | B–R ,, ,, ,, ... ... ... | 6·2 | 7·1 | 7·1 | 7·5 |
| 5/6 | All Links & Earth ... ... ... | 0·4 | 0·3 | 0·4 | 0·3 |
| 6/7 | R–Y Link & Earth ... ... ... | 8·7 | 8·9 | 12·4 | 11·9 |
| | Y–B ,, ,, ,, ... ... ... | 7·4 | 8·4 | 7·3 | 8·1 |
| | B–R ,, ,, ,, ... ... ... | 12·4 | 12·4 | 8·7 | 7·9 |
| 7/8 | R–Y Link & Earth ... ... ... | 12·4 | 13·2 | 8·7 | 9·3 |
| | Y–B ,, ,, ,, ... ... ... | 8·7 | 9·8 | 11·5 | 13·5 |
| | B–R ,, ,, ,, ... ... ... | 7·4 | 8·9 | 7·3 | 8·3 |
| 8/9 | All Links & Earth ... ... ... | ALL LINKS BONDED TO EARTH AT THIS JOINT BAY | | | |

Group (c) tests were carried out to find the effect on sheath voltages occasioned by mutual induction between the two circuits as installed. It was found that there was a 10 to 15 per cent increase in the maximum sheath voltage, as can be seen by comparing Table 3 with the voltage readings obtained with the 250 A test in group (a), shown in Table 2. Further calculation has shown that this effect could be reduced by modifying the disposition of the phase cables in the trench.

The experience gained on this installation, together with the results of the tests performed on the system, has confirmed that cross-bonding is a highly practical method of obtaining considerably increased cable ratings when large conductor single-core cables are used. It is effected with relatively simple modifications to existing installation techniques. The saving in conductor section and cable costs is partly offset by a slight increase in the cost of joints, the supply and installation of link bonding boxes and increased excavation and reinstatement costs necessitated by the wider trench sometimes required for flat cable spacing. For conditions of heavy load requirements, however, when single-core cables are necessary, a cross-bonded system offers an economic advantage over methods of installation employing solidly bonded sheaths.

The increase in maximum sheath voltage, due to mutual inductance between adjacent circuits, does not impose a limitation on the design of a cross-bonded system, as the reduction in permissible conductor current, through mutual heating between the two circuits, is of the same order as the voltage increase. Thus, although for a given conductor current the maximum induced voltage may be increased by the simultaneous loading of adjacent circuits, the maximum load on each circuit with both simultaneously operated is correspondingly reduced with very little net change in standing voltages.

Whilst it is not considered necessary to carry out the extensive programme of tests described above on all new installations, it is essential to ensure that all bonding connections are correctly made. This can be checked by continuity tests at the link box positions during the progress of the installation and prior to commissioning.

## Acknowledgment

The authors are grateful to the chief transmission engineer of the Central Electricity Generating Board and to British Insulated Callender's Cables, Ltd., for permission to publish the information contained in this article.

### REFERENCES

[1] "A Technique for Calculating Inductance, Reactance, Impedance and Sheath Voltage of Single-Conductor Cable in Duct Banks." Buller. *General Electric Review*, March, 1949, p. 40.

[2] "Reduction of Sheath Losses in Single-Conductor Cables." Halperin and Miller. Trans. A.I.E.E., January-February, 1929, p. 399.

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# NEW BOOKS

**First Aid in the Factory.** By Lord Taylor, B.Sc., M.D., F.R.C.P., and others. Pp. 140; figs. 72. Longmans, Green & Co., Ltd., 6 and 7, Clifford Street, London, W.1. Price 9s 6d.

In spite of statutory and voluntary precautions industrial accidents will happen and measures to deal with them must be instituted. Factories of suitable size can employ doctors and trained nurses, but the majority of small works have to rely on " amateurs " for first-aid treatment. This book aims at instructing these people in methods of handling all kinds of personal injuries. The instruction is in easily-understood terms and helpful illustrations are included.

The treatment of electric burns and shock is dealt with in a general chapter and there is a separate section on artificial respiration in which the Holger-Nielsen and the Eve rocking-stretcher methods are given prominence. The book concludes with a " miscellany " in which various general points are put forward and a kind of examination paper on first aid is included. There is a good index. —J.H.C.

**Direct Current Machines.** By H. B. Ranson and E. T. A. Webb. Pp. 320; figs. Cleaver-Hume Press, Ltd., 31, Wright's Lane, Kensington, London, W.8. Price 21s.

This is the second edition of No. 2 in the Cleaver-Hume Electrical Series edited by Prof. H. Cotton. It was first published in 1952 and only a few changes have been deemed necessary by the authors, the most notable being the use of the M.K.S. system in the small amount of mathematics included, while references to British Standards have been brought up to date. A large number of new illustrations have been incorporated and there are some test questions with answers provided to those of a numerical nature.

## Books Received

**Induction Heating.** Coil and System Design. By P. G. Simpson. Pp. 295; figs. McGraw-Hill Publishing Co., Ltd., McGraw-Hill House, 95, Farringdon Street, London, E.C.4. Price 89s.

**Video Tape Recordings.** By J. Bernstein. Pp. 268; figs. John F. Rider Publisher, Inc., New York, and Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 72s.

**Magnetic Materials in the Electrical Industry.** By P. R. Bardell. Pp. 320; figs. MacDonald & Co. (Publishers), Ltd., 16, Maddox Street, London, W.1. Price 32s 6d.

**David Brown's.** The Story of a Family Business, 1860-1960. By Desmond Donnelly. Pp. 128; figs. Collins Publishers, 14, St. James's Place, London, S.W.1. Price 21s.

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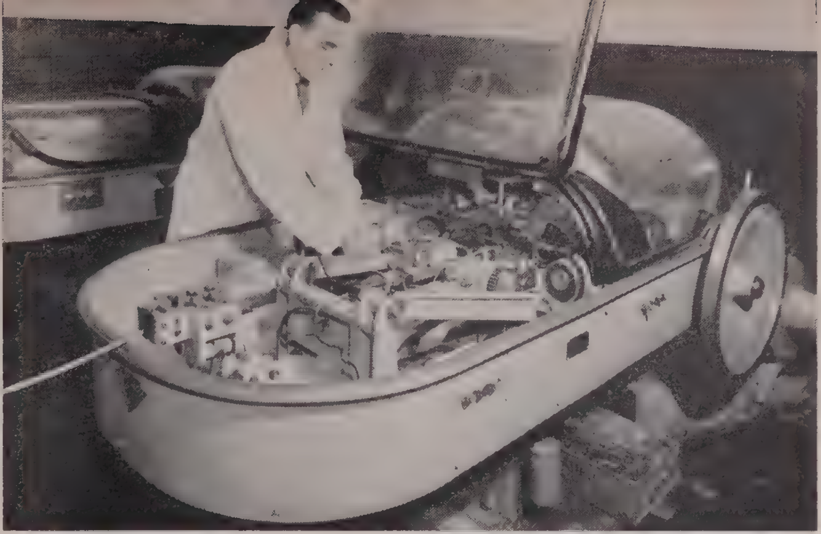
## Light Source Measurement

IN B.S. 354:1961 (which contains recommendations for photometric integrators for the measurement of all normal light sources), the text has been amended to cover the testing of tubular lamps and recommendations relating to accuracy of measurement have been included. In addition, the appendix, which contains formulæ for suitable paints for the internal surface of an integrator, has been revised. Copies may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 4s.

## Component Production for the Electrical Industry

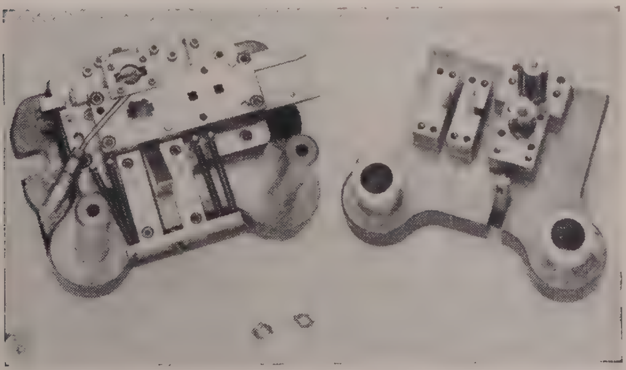


*One of the "Multiform" four-slide machines*

# BERYLLIUM COPPER PRESSINGS

FOR many years pen nibs were the only product of the Birmingham firm of C. Brandauer & Co., Ltd. Founded nearly 100 years ago, the company expanded until at the beginning of the century 750 people were employed, producing a million nibs daily, each of which was subjected to 23 separate processes. The decline in the demand for nibs with the advent of the fountain pen, typewriter and telephone caused the firm to widen its interests and since the early 1930's an increasing proportion of the output has been in the form of components for the electrical industry, until today some 80 per cent are in this category, of which nearly two-thirds are in beryllium copper. The 150 employees at the Birmingham factory, which has a total of 30,000 sq ft of floor area on three floors, produce some three-quarters of a million electrical and electronic components daily, including springs for toggle and wafer switches, fixing straps for micro switches, potentiometer brushes, plugs and sockets for instrument and telecommunication circuits, crystal holders and transistor headers, eyelets and cans.

Although a number of alloys and metals are processed —including mild and stainless steel, brass, nickel silver, phosphor bronze, aluminium and cupro-nickel alloys, a composite alloy containing platinum, palladium, silver and gold used for wiping contacts, and silver brass, silver copper and silver phosphor bronze bi-metals—one in which the company specialises is beryllium copper. This alloy has a nominal composition of electrolytic copper with 2 per cent beryllium and 0·25 per cent cobalt added. It is a good conductor of electricity and has high tensile strength and elasticity and is therefore most suitable for components which in service may be subject to deflection and required to regain their original form. Since it is a precipitation hardening alloy, susceptible to heat treatment, intricate shapes formed in the metal's relatively soft state are maintained during heat treatment which improves the tensile strength. During this treatment, which is carried out at 315°C for periods varying between one and two hours according to the type of components, the tensile strength can be increased to 90 tons/sq in and the hardness figure to about 400 D.P.N. The elasticity in this state is such that there is an approximate elongation of 4 per cent, compared with a figure of 40 per cent before treatment. The material has a conductivity of 32-38 per cent I.A.C.S. (International Annealed Copper Standard).

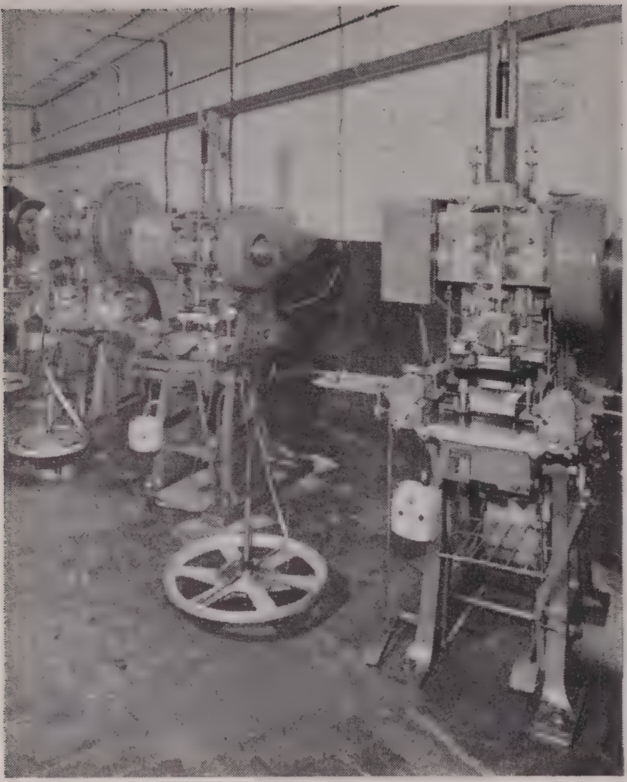


*A piercing, blanking and raising transfer tool for installation in a 10 ton roll fitted power press to produce the component in the foreground from $\frac{5}{16}$in by 0·0148in soft brass*

The majority of springs, clips, contacts and similar components are produced from strip or wire. The high cost of beryllium copper of some 25s per lb compared with the 4 to 5s per lb of phosphor bronze is offset by the reduction in size of a component giving the same or an improved performance. Since beryllium copper is not subject to minute particle incandescence, it is employed for safety tools used in areas where explosive mixtures might be ignited by sparks and since it is non-magnetic it is also employed for tools specifically for use with electronic equipment where this property is essential.

A major factor in the production of precision components, for some of which an accuracy of ±0·00025in is maintained, are the press tools which are made by Brandauer in their own tool room. Many tools contain up to 50 parts, all ground to within ±0·0001in, and any cumulative error which may occur is eliminated during assembly. This section makes use of many special jigs, attachments and checking instruments in addition to precision grinding machinery which can produce finished tool components down to an external diameter of 0·0125in and an internal diameter of 0·0625in.

In the power press shop the various machines are



*Some of the machines in the power press shop*

capable of exerting pressures of from two to 20 tons. Usually double-roll feeds integral with the press are employed and all presses are fitted with automatic coil handling equipment. Straightening rolls can be used when necessary. Some presses are fitted with balanced slides to ensure accurate movement of the top part of the tool and a number are driven by variable-speed motors enabling the highest practicable production speeds to be used. Air ejection sets are fitted to each press and are used when compound, combination or transfer tools are installed.

The Heenan " Multiform " multi-slide wire and strip automatic machines can be fed with wire, strip or a combination of both direct from coils. By the co-ordinated use of four forming slides disposed around a central forming mandrel situated alongside a press station the material fed into the machine can be straightened, trimmed, blanked, embossed, coined, lettered, cut off, formed into shape and ejected in one cycle. In general, most formed parts, to a maximum developed length of 8in by 1½in wide, made from strip metal, can be automatically formed from coiled stock on these machines. A number of components can be produced during one machine cycle. One, previously requiring seven separate press operations, is now produced at a rate of four per cycle at a machine speed of 200 r.p.m., giving an output of 48,000 parts an hour. Some 300,000-400,000 parts are usually obtained from each machine weekly. Components having only a short production run are manufactured in the hand press shop which is equipped with small toggle presses and conventional fly presses. Power presses are used where there is a secondary operation requiring a fairly large pressure.

Annealing is carried out in gas-fired muffle type furnaces having a temperature range of up to 1,000°C, the components either being packed in fine sand or treated in a purged atmosphere. Carbon steel components are hardened in a Wild-Barfield electric shaker hearth furnace having a temperature range up to 950°C. Beryllium copper and certain cupro-nickel alloys are hardened in either a gas-fired forced draught furnace or an electric muffle furnace in which the atmosphere is purged by cracked ammonia gas. For certain components, tempering is necessary, and this is also carried out in a heat treatment shop in either an atmosphere-controlled air circulating type furnace or a rotating furnace. The components are de-burred and polished in rotating barrels loaded with a suitable compound. The finishing department is equipped with a drying plant and a bright dipping plant for cleaning components after hardening and tempering. In addition to tests in the final inspection department, which is A.I.D. approved, the components are checked at all stages of pressing and heat treatment.

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# THIN MAGNETIC FILMS

THE use of thin films of magnetic material for computer stores was explained by E. M. Bradley in a lecture to the Measurement and Electronics Sections of the Institution of Electrical Engineers last week. The important difference in ferro-magnetic behaviour between the bulk material and some thin films was that in a specially prepared film the electron spins contributing to the magnetisation could be made to rotate coherently rather than sequentially as in a domain-wall-motion process.

The coherent-rotation process could be described with good accuracy by a simple model and could, in certain circumstances, be a very fast process. Both these properties were exploited in computer storage devices using thin magnetic films.

It had been found that the magnetisation-reversal process in small isolated areas of film of a size required for use in a computer store was not sufficiently coherent for a useful device to be made; this was thought to arise from the presence of edge domains. However, if the element area was selected from a large sheet by means of localised magnetic fields, it had been found possible to obtain sufficiently coherent rotation. The localised magnetic fields might be conveniently generated by passing a current through a strip line very close to the film.

Several modes of operation exploiting the fast coherent-rotation process were possible, all of which depended on control of the direction of the easy magnetic axis over the area of the film, but did not depend upon accurate control of the easy direction coercivity. The method of measurement of the direction of the easy axis by a pulse technique was described and comparison between films of nickel iron and a newly-developed alloy, Gyralloy, was made. In conclusion, an example of a storage device was briefly described.

# Arc Damage to Insulators

By **A. E. GUILE**, Ph.D., B.Sc.(Eng.), A.M.I.E.E.

Author's summary of a paper entitled "The Protection of High-Voltage Insulators from Power-Arc Damage" which was read before a meeting of the Supply Section of the Institution of Electrical Engineers on 1st February

SOME years ago the Electrical Research Association was asked to investigate whether or not arcing horns prevented damage to porcelain bushings and cable sealing ends when flashover occurred due to surface pollution. After some discussion it was decided to test line insulators as well as bushings suitable for system voltages from 6·6 to 33 kV. This limit was imposed to avoid the need for a very large wind tunnel, and because it was felt that information applying to large insulators could be deduced from the results of such tests.

The investigation was carried out for the E.R.A. in the short-circuit laboratory at Queen Mary College, University of London. After some information had been gained by means of a moderately high-speed camera, on the relative effects of magnetic and wind forces on an arc, a number of bushings were tested. In all tests the arc duration was one second and the current varied up to 1,400 A.

### Conditions Causing Fracture

The bushings were tested in still air and in a wind up to 60 m.p.h. The arc was initiated in one of two ways:—(i) by fuse wire joining the tops of the horns (or nearest metal parts where no horns were used)—this simulated a power arc following lightning flashover; and (ii) by fuse wire lying across the insulator surface to simulate an arc caused by flashover due to surface deposits. It was found that the sheds could be fractured under the following conditions:—(a) in still air when the arc was initiated according to (ii) in a position some way from the horns and failed to reach them, (b) in a wind when the arc between the horns was blown towards the sheds, and (c) when the wind was strong enough to blow the arc to the down-wind side of the bushing.

The remedy suggested is to have the horn tips at a minimum safe distance from the sheds and to have deflector rings. For bushings with only one pair of horns, another pair opposite to the first would be needed. In 250 tests on unprotected bushings, 15 fractures occurred of which five were in the first test on a new bushing, but with modified fittings a similar number of tests caused no fractures at all, even though these latter tests were all under conditions shown by the earlier tests to be particularly dangerous. Tests were made on porcelain and toughened glass pin insulators, porcelain pedestal and solid-core insulators and on suspension insulators.

The usual shape of stirrups for pin insulators, shown in B.S. 1320:1946, was found to increase the risk of shed fracture and this was modified. In general, pin and post insulators were not subject to such serious damage as bushings. In the case of suspension insulators with no protection fittings, it was found that either the line or earth-end unit could be damaged, with more chance of the former. This could occur either in still air or with wind blowing parallel to the conductor. After double-point arcing horns had been fitted it was still possible for the bottom shed to be broken if the wind was at right-angles to the conductor. For this reason a deflector ring at the bottom of the string was advocated.

To obtain some information on the relative effects of current magnitude and arc duration, toughened glass discs were placed in a gap between electrodes. Curves were obtained showing that as the current increased the minimum arc duration for fracture decreased and seemed to indicate that above 1,000 A the minimum time for fracture fell only slowly below half a second.

The particular bushings and insulators tested were chosen because of convenience and it is not the purpose of the paper to urge that the insulators tested should have fittings modified or added. The aim has been rather to give information which can be applied to examining the protection of insulators and particularly bushings up to the highest system voltages. The case for modifying fittings on any particular insulator can only be judged locally by those experienced in operating conditions.

### Experience in Different Areas

In Great Britain on systems up to 66 kV only about 1·5 insulators per 100 route-miles per annum (i.e. 0·04 per cent per annum) sustain damage due to lightning, and in one-third to one-half of these cases interruption was not persistent, i.e. the supply was restored at once and the insulators could be replaced later, if necessary. In general, insulators at special positions such as switchgear, transformers and tee points, have a rate of damage some 2½ times the overall figure given above. Rates of damage vary greatly between Area Boards, between different localities in one area and are affected by the level of fault current and relay settings, e.g. they may be high near major supply points. It may be noted that on unearthed systems, damage is only one-half to one-third of that on earthed systems so that greater use of the former will further reduce the rate of damage.

In the case of bushings the rate of damage is higher, being in some areas about 0·2 per cent per annum. In the case of external flashover of transformers, a persistent fault may occur in about two-thirds of the cases.

There is evidence from supply authorities abroad that the rate of damage to bushings in a few cases is as much as ten times higher than in Britain, so that the case for modification there may be stronger. It must be remembered though that many engineers would prefer to remove fittings altogether, rather than to modify or add to them, since they increase the risk of interruption of supply due to vermin and birds, particularly on systems up to 33 kV.

## DISCUSSION

Mr. N. G. Simpson (B.I.C.C.), in opening the discussion, said that the author had shown commendable objectivity and a very interesting and progressive treatment of a subject on which information was somewhat lacking, but he felt that it badly needed a companion paper dealing with the experience of users or of the supply undertakings. He was unable, however, to accept the statistics given, and stressed the importance of a correct perspective on insulator failures. Seasonal effects and regional influences (the local incidence) were of more importance when set against an overall average.

The future trend on overhead lines must be to improve reliability. The most important contribution to the operational efficiency of insulators in the high-voltage range since the war had been un-earthed construction, involving a completely new technique: the principle of " defence in depth." Overseas, it was being increasingly adopted, utilising the insulation and impulse values of the supports as far as possible. On 33 kV circuits in Britain and overseas a prominent advantage was flashover immunity from birds, vermin, etc., and a measure of immunity from lightning. Despite the advantages there was nevertheless a lack of balance, which might be improved by using wooden cross-arms, but they continued to have mechanical and electrical instability. Certain developments were also taking place with moulded resins and plastics. A new form of transmission was being used on railway overhead electrification, and the author's technique would be extremely useful in application to the insulation of those systems.

Mr. D. F. Oakeshott (Central Electricity Research Laboratories) referred to four remedial measures set out in the paper: elimination of projections on the central collar; moving the lower horns a distance of 2½in from the sheds; fitting U-pieces on the central horns; and fitting deflection rings at the top, centre and bottom of the bushing. The first three were feasible, but the fourth modification did not appear to be practicable for use in Britain, because it seemed to nullify the major feature, the *raison d'être*, of the duplex gap, making it even more liable to flashover from birds and debris; the phase clearance might result in increased expense; and the impulse characteristic was very considerably modified. A short investigation of this characteristic had indicated a reversal of the normal polarity effect: the negative flashover was some 16 per cent greater than the positive, not necessarily a worse performance, but emphasising the need to look more closely into it before it was used. The paper served usefully to draw attention to a case where a very small modification should greatly lessen risk of damage due to arcing.

Mr. D. J. Miller referred to the author's test on a type C pin insulator in which he was unable to obtain a fracture under similar circumstances to which fractures were obtained in types A and B. The author had ascribed this to the upper copper cap being mounted some small distance above the top shed in type C, and it seemed remarkable that this should have produced such a large effect; but, if so, it pointed to the fact that a large part of the energy was dissipated at the arc root. If that was true then the modification seemed to be well worth doing. He was, however, alarmed at the suggestion of going back to uninsulated systems, believing that the losses would far outweigh any gains, especially from the point of view of capacitive transfer through transformers, and he hoped that the change would not be pleaded seriously.

Mr. R. N. Buttrey (South Wales Switchgear), referring to breakage of porcelain on flashover, felt that there was good cause, in line with the author's recommendations, to develop a form of arcing horn for the circuit-breaker bushing, sloping outwards, as this might avoid breakage. They could not put the arcing horns on the top of the bushing, otherwise it would be blown up between phases.

Mr. L. Gosland (E.R.A.) thought that the practical level of the paper, originating as it did from a university post-graduate school, was rather an unusual feature, and valuable in that it would illustrate to students the practical as well as the fundamentally theoretical side of their work.

Mr. F. C. Walmsley asked whether the author had studied what effect there might be if there were two parallel sets of current in opposite directions. With regard to arcing, it was not so easy to get the arcing on the upper side because invariably the switchgear was designed for getting the two arcs as close together as possible, and one was limited by clearances, so that he wondered what the author's approach to that aspect had been.

The chairman, Mr. J. E. L. Robinson (Associated Engineering, Ltd.), said that the author's results in his experiments used for initiating the arcs seemed to be cancelled out in that he had demonstrated that the damage had disappeared after treatment, and he imagined that it did not very much matter how the simulation was produced if the change-over was limited in practice, and he was not very clear how far that had been established in practice as distinct from the experiments based on the same method of initiation.

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## Dielectric Rubber Thawing

A plant which thaws frozen bales of natural rubber in less than an hour—compared with up to five days' thawing time by conventional methods—has just been dispatched to Russia. It will be erected at Dnepropetrovsk, where Rustyfa, Ltd., a consortium of British firms whose consultants are Dunlop Advisory Services, Ltd., is completely equipping one of the world's largest tyre factories.

The change in the physical state of natural rubber when stored for extended periods, particularly under very cold conditions, and the fact that the new factory will use four tons of rubber an hour, made it imperative to find more rapid means of warming the raw material to a condition where it could be fed into processing machinery.

Rustyfa worked in collaboration with Radyne, Ltd., of Wokingham, to develop the radio-frequency thawing of frozen rubber and after the electronic end of the process had been developed, Baker Perkins, Ltd., Hebburn-on-Tyne, devised a conveying system in collaboration with Dunlop which passes the bales of frozen rubber under dielectric heaters. A similar thawing plant is at present under construction for another tyre factory in Rumania, which is also being built by Rustyfa.

*In St. Mark's Church at Leicester 4 kW units are mounted 23ft above floor level, giving a heating density of 20 W/sq ft with a total load of 60 kW*

# Heating by Infra-Red Radiation

**By R. J. FRANCIS***

**Heating by infra-red radiation is ideally suited to applications where short-period warmth is required or where there is considerable air movement and for these it is becoming widely used. Readers may remember the author's previous article, "Church Heating by Infra-Red Radiation," in our issue of 11th September, 1959. In this article Mr. Francis introduces the reader to more specific factors which affect the design of both the infra-red heating units and the complete installation**

INFRA-RED radiation is a term given to heat falling within the infra-red band of the spectrum. By selecting a frequency peaking at 3 microns and between the waveband of 2-4 microns, over 92 per cent of the energy produced by the equipment is transmitted forward in the form of useful heat. This energy can be transmitted through the atmosphere without becoming absorbed, but upon striking a solid object the heat is usefully collected and the secondary effect of raising the air temperature occurs. Air movement does not affect the heat emitted from a 3 micron infra-red radiator and its use is therefore ideal in circumstances where it would be uneconomic or impossible to heat the total volume of air or where the air movement is so great that any convected heat currents produced would be rapidly dissipated. Another application occurs where heat is required quickly and for short periods of time.

Although the amount of radiations generated will vary with the substance, the wavelength of the radiation is dependent only upon the temperature. According to their wavelength, electromagnetic radiations produce differing effects, the whole spectrum ranging from the shortest gamma rays to the long-wave radio waves. For heating, only that part of the spectrum covering the light and infra-red rays need be considered (it is estimated that 46 per cent of the sun's energy is given off in the form of light and 43 per cent in the form of heat). These wavelengths are measured in Angstrom units and microns (10,000 Angstrom units=1 micron and 1,000 microns=1 centimetre). The light range extends from the violet at 3,950 Angstrom units to red at 7,661 Angstrom units: the infra-red range extends beyond this to about 420 microns, but for heating purposes wavelengths in the range 0·75 to 12 microns are employed.

There are two types of infra-red generators known as bright emitters and dull emitters. The most common bright emitter is in the form of a lamp with a tungsten filament heated to a glowing temperature of between 2,000 and 2,500°C, operating with a peak wavelength of about 1·3 microns. The dull emitters operate at temperatures between 250 and 1,000°C. Their peak wavelength is

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* Manager, Infra-Red Division, Thermodare (Great Britain).

*The works canteen of Elliott Bros. at Rochester is heated by infra-red units. This photograph was taken using infra-red sensitive film and illustrates the heating coverage achieved*

dependent upon the temperature of the elements, the most efficient being at about 3 microns with operating temperatures between 860 and 1,000°C, at which an efficiency of 92 to 93 per cent can be obtained.

It is not possible for a body, other than a hollow-spaced black body, to attain 100 per cent absorption over the full wavelength range. The molecules to be heated are most receptive to a fixed wavelength, and the radiator must be designed to operate over the absorption wavelength of the substance to be heated. With infra-red radiation, a broad frequency band is generated with peaks becoming more definite as the temperature of the radiator—and hence the frequency—is increased. At radiator temperatures between 300 and 1,000°C the radiated wavelength is mostly in the long-wave infra-red range in which the absorption constant of most substances occurs. Water has a maximum absorption of radiant energy of 2·7 microns in wavelength, and since the human body contains a high percentage of water it will absorb the maximum amount of heat at that wavelength.

## Heater Design

For maximum efficiency the equipment must produce radiant heat with the minimum of convected heat dissipation. The convection losses depend on the temperature of the radiator and the area in contact with the air. It is therefore desirable to have an element manufactured in an alloy with good infra-red emitting properties and, to reduce the heating surface in contact with air, enclosed in a housing for which pure fused silica is a perfect medium.

Fused silica is obtained by melting high purity sand at temperatures in the region of 2,000°C. Nemours silica sand will produce a refractory material capable of withstanding temperatures of 1,100°C indefinitely with an almost negligible thermal expansion. It is a bad heat conductor but is highly transparent to infra-red radiations, it supports the elements and since it has a lower external than internal temperature, convection losses are considerably reduced. Theoretically, gold is the best reflector, but its use is impracticable except for highly specialised applications and high purity polished aluminium is mainly used for the purpose.

## Heating Installations

In an infra-red radiation heating system where a constant temperature in the form of a layer of heated air surrounding the body is not being provided, it is important that the body is completely covered by radiation and for this reason it is usual to mount the radiator units at wall-plate level suitably angled. Where a single heater is used, as in the case of a person at a stationary isolated work position, it should be directed towards the back of the person where the heat reacts on the sympathetic nervous system. In the United Kingdom it is common practice to use a loading of 12-15 W/sq ft for reasonably well insulated buildings. Where the length of occupancy is over a full working day the lower of the values may be used, but for more intermittent heating of shorter duration the higher loading would be taken. For buildings having a high level of cold mean radiation—old stone churches with thick walls being a typical example—loadings in the region of 20-22 W/sq ft would be needed.

In practice, it has been found that these loadings apply to the majority of buildings, but in certain circumstances it may be necessary to calculate the heating needed to meet the particular requirements of a building. The formulæ used involve the multiplication of Um, the mean "U" factor for the building construction, by the temperature differential and by a factor which varies from 100 per cent where an immediate heating response is required to 70 per cent where half-hour preheating is possible, 50 per cent with one hour preheating and 30 per cent with two hours. For example, where Um=0·40 and the temperature differential is 30°F (60-30°F) and with half-hour preheating, then the loading should be $0{\cdot}40\times30\times\frac{170}{100}=20{\cdot}4$ W/sq ft of floor area. The "U" factor is the coefficient of transmittance for the building and relates to an overall figure of heat transfer from the air inside, through the building material, to the air outside.

## THE HOME LAUNDRY

The subject of next week's illustrated domestic equipment supplement will be washing machines and wash boilers. The tabulated imformation will include size, clothes capacity, washing action, finish, price, and the names and addresses of makers or distributors

# VIEWS on the NEWS

By "REFLECTOR"

IN the electrical profession and industry there are many "accepted" names; that is, everybody knows them, but often knows little about them. I must confess that I sometimes find myself in this class and I was therefore glad to be lent a copy of a privately-published book called "Progress in Power" by John Rowland, which, as its sub-title indicates, describes the contribution of Charles Merz and his associates to sixty years of electrical development. Merz & McLellan are such a well-known firm of consulting engineers that it interested me to be reminded of the prominent electrical engineers who have been partners in the firm and to have particulars and pictures of some of the many large electrical undertakings with which the firm has been identified. It is a pity that the book is not on sale, but I believe that the firm has a limited number of copies available for those interested in electrical history.

* * *

A Trinidad correspondent tells me that recently "with sadness and apprehension" the people of Mason Hall, Moriah and Runnymede Villages in a remote part of the holiday island of Tobago, West Indies, said farewell to a landmark which had watched over them, their parents and their parents' parents for many generations from just outside Moriah. On 18th January a worker of the Trinidad and Tobago Electricity Commission had the unenviable task of bringing to an end the life of their silk cotton tree, said by some to be eight hundred years old. Although its girth was about 42ft it proved to be hollow and easily felled, maybe it would soon have fallen even if it had not had to make way for modern progress in the form of all the conveniences of electric power. Many of the older folk, however, whose life and aspirations, hopes and requests have for so many years been communicated to the tree, must have at least partly wondered whether this final sacrifice of the tree for their greater physical safety and greater material comfort would also profit spiritual well-being.

* * *

I am rather intrigued about the description of an electric shaver patented recently in America, which I have seen in the *Financial Times*. Apparently this appliance has "a low amperage current at 600 to 800 volts which is fed to alternate metal teeth in a cutting head shaped like a comb." The teeth are from three to five thousandths of an inch apart and those not energised are earthed to the transformer, presumably in the shaver itself. In operation the beard is "burned off" by arcs passing between the teeth. Although it is stated that insulation prevents the current from reaching the skin, I cannot help having doubts about 800 V hair-burning arcs; it sounds somewhat akin to spark erosion. Until I have further information about results, from actual users, I intend to stick to more orthodox methods of shaving.

* * *

Education of women in electrical matters is one of the main objects of the Electrical Association for Women, but its scope is widely misunderstood. Members are frequently referred to by the Press as "women electricians" and now I find a report of a talk on house wiring given at the Derby Branch of the E.A.W. headed: "These women know how to wire a house." While they may know, I trust that few of them will actually do it themselves.

In this same connection, by coincidence, *Live Lines* (Wellington) reports a meeting at which it was decided to proceed with the formation of a branch in Wellington of the Electrical Association for Women in New Zealand. The chairman of the interim committee which was set up said:—"In due time classes in simple electric household wiring and repairs, such as the wiring of fuses and plugs would be started." I cannot imagine that in New Zealand, which has very stringent regulations governing the carrying-out of electrical installation work, electric house wiring, even of the simple type, by housewives will be allowed to go very far.

* * *

Although it is true that in many respects things are not what they used to be, in other ways they are much the same. Our unsatisfactory position in the matter of export trade is strangely like that of sixty years ago. The leading article in the *Electrical Review* of 8th February, 1901, recounted the adverse influences then operating—the intensive competition of the United States and Germany and the greater assiduity of their workers, the constant wrangles between "masters and men," restrictive trade union practices, etc. It might have been a Board of Trade spokesman of today speaking when it was said:—

> "But it is not only the working man who requires education. British merchants and captains of industry have yet to learn that only by a study of the demands of the world's markets, comparable with the pains taken to master them by our competitors, can they hope even to maintain Great Britain's position in the present, much less to regain its supremacy of the past. More organisation and interchange of information are required."

# SILICON POWER RECTIFIERS

## Their Design and Characteristics

THE development of the silicon power rectifier was surveyed in a Utilisation Section paper presented at a meeting of the Institution of Electrical Engineers on 2nd February. This form of rectifier is now well established for use over a wide range of voltages and currents and the authors of the paper—Messrs. A. J. Blundell, A.M.I.E.E., A. E. Garside, B.Sc. (Eng.), Graduate I.E.E., R. G. Hibberd, B.Sc., A.M.I.E.E., and I. Williams, B.Sc., A.M.I.E.E.—considered that it would in all probability remain as a standard class for many years. The paper opened with a brief survey of the processes involved in the preparation of single-crystal silicon and this was followed by sections devoted to design considerations and process techniques used in the preparation of silicon rectifier cells. The electrical characteristics and ratings of rectifier cells, and the considerations involved in their operation in rectifying equipments, were discussed in some detail and brief mention was made of the various fields of application in which silicon rectifiers offer advantages.

The latest device of this class—the silicon controlled rectifier—was also described, and its importance in the future emphasised. (An article by one of the authors, Mr. A. E. Garside, describing the design, manufacture and characteristics of the controlled rectifier was published in the 6th January issue of the *Electrical Review.*) In conclusion, the authors stated that for very special industrial and aircraft applications, operation at ambient temperatures higher than those possible with silicon would be required, and, in this connection, work was already proceeding on high energy gap compounds such as silicon carbide, gallium arsenide and aluminium antimonide, with a view to developing rectifiers for use in the range of 250-500°C. Low-voltage silicon-carbide *p-n* junctions had already been demonstrated operating at 500°C. However, it did not appear likely that they would be able to challenge silicon for general use at moderate temperatures. The controlled rectifier would undoubtedly be extended to the very-high-power field.

Several theoretical aspects of the forward and reverse characteristics of silicon rectifier cells were treated in the appendices to the paper.

### DISCUSSION

The discussion was opened by Major L. H. Peter (Westinghouse Brake & Signal Co.), who said that now that these devices were coming into everyday use it was necessary to look again at the nomenclature; there was at present no set method of defining a cell's possibilities. A method, not mentioned in the paper, of providing protection against surges was the use of one rectifier as surge suppressor for another. The selenium rectifier, which had a very rapid dropping off reverse resistance characteristic, was often used to protect germanium or silicon rectifiers and was a comparatively cheap and not always too bulky a method of doing so.

Mr. J. E. Boul (English Electric Co.) asked why, for the smaller rectifiers, the authors considered it desirable to have only one reverse voltage rating, the crest working maximum voltage being equal to the peak transient reverse voltage, while for large rectifiers there were two values, the p.t.v. being higher than the c.w.v. Many references were made in the paper—he thought rightly—to the fact that the small cell was treated differently from the large cell. Efforts were being made at national and international levels to prepare standard specifications for these devices and for the equipments using them. A distinguishing line would have to be drawn somewhere between the heavy current device and the lower current device, but so far it had been difficult to know exactly where to draw the line.

### Crystal Imperfections

Mr. A. Langridge (Westinghouse), dealing with the crystal material, said that materials having identical specifications could give very dissimilar results when used in devices, due to certain imperfections associated with the material which could be brought out by using special techniques. By the careful selection of material on the basis of imperfections, characteristics of the kind desired could be obtained in controlled rectifiers. He also referred to experiments carried out on thermal fatigue, using different materials interposed between the silicon and the copper. While slight improvements could be made, the only successful solution was the hard soldering of all the components in the junction. When junctions were made in this manner the stress applied to them during the cyclic temperature excursions occurred in the elastic region and the cell had an infinite life.

Mr. D. R. Coleman (Standard Telephones & Cables), said that there were silicon rectifiers on the market with a higher crest working voltage than 600 V and able to withstand peak transient reverse voltages greater than 1 kV. He supported Mr. Boul on the need for both manufacturers and users to be clear about what certain descriptions and parameters meant. Fig. 4 of the paper showed alarming differences in encapsulation which must be very disturbing to the user. There ought to be a more standardised form, especially for the smaller devices.

Mr. R. A. A. Newman (Westinghouse) said that during a surge current the junction temperature of the rectifier rose to very high values. It was normally assumed that breakdown occurred because of the melting of one of the components in the junction or as the result of voltage breakdown, but they had found that it could easily take place due to purely mechanical stress in the junction assembly, if the production of the assembly had not been perfect. In the production of a number of silicon power rectifiers the application of a very short time current surge would eliminate all the diodes which exhibited this fault.

Design approval tests on prototype diodes were lengthy and laborious; what was wanted was a quick test to show whether or not the diode was likely to be any good. He had found that a temperature cycling test, giving the diode a period of electrical heating up to the proposed maximum junction operating temperature and then forced cooling to room temperature, without any reverse voltage applied, could be made quickly and easily and about 1,000 cycles was sufficient to anticipate any early failure which might otherwise occur on life test.

Mr. W. R. B. Taylor agreed with previous speakers that there seemed to be no reason for medium power diodes having the same figure for crest working voltage and peak transient voltage. It was his experience that with these small equipments, to which no particular engineering thought was given, there was a tendency to ask for one " off the shelf." The result was all sorts of transients due to ill-regulated and sudden switch-ons at a remote end of the factory. The large equipments, on the other hand, were seriously engineered and surge divertors with specified impulse levels were included.

# INDUSTRY AND THE HOUSE

## Railway Modernisation Uncertainties

By **AUSTEN ALBU**, M.P., B.Sc., A.M.I.Mech.E., M.I.P.E.

THE House of Commons has not for a long time listened to such a cool, dispassionate analysis and destruction of the proposals in a Government White Paper as it heard during the debate on the reorganisation of the nationalised transport undertakings from the Rt. Hon. Aubrey Jones. Mr. Jones is a Conservative and a former Minister of Supply and Minister of Fuel and Power. The son of a miner and educated at the London School of Economics he speaks with an academic precision that distinguishes him from many of his colleagues and does not, perhaps, endear him to them.

### Stedeford Report

On this occasion he started, as he said, by fulfilling an omission of previous speakers by expressing gratitude to the Stedeford Committee. This raised the temperature of the Labour benches, where members have never had any use for the Committee at all, until Mr. Jones went on severely to criticise the Government for not publishing the Committee's report. On the White Paper, he said that the important problems were not touched in it and he mentioned as the first the Government's relationship with the proposed British Railways Board. He pointed out the increasing degree of Ministerial interference in the affairs of the British Transport Commission, particularly in the spheres of charges, wages and capital expenditure. He doubted whether men of the background and experience needed would be recruited to the Board if it remained in thraldom to the Minister of Transport. On charges, he asked which of the two unpopularities did the Government prefer—the unpopularity of seeing fares and charges rise, or the odium of so mismanaging the railways that they had permanently to subsidise them. Compared with these problems, he said, the organisational problems set out in the White Paper were of minor importance.

Mr. Jones said that he regretted that his party had appeared to attach itself without qualification to the principle of decentralisation. Whether a decentralised or centralised structure was appropriate depended on the true scale. When planning ahead one required quite a high degree of central power. The proper distribution of power should be left to the Railways Board. He was against the proposal for geographical representation on the Board, which departed from the decision the Government had taken following the recommendations of the Fleck Committee in the case of the National Coal Board. He was against the constitution of the proposed National Transport Advisory Council as a collection of sectional interests and against the Minister as its chairman. Each enactment in transport legislation, he said, had been behind the event and he thought that posterity would pass the same judgment on the White Paper. Finally, he urged on the Minister the speedy execution of the modernisation programme, pointing out that the most effective way of wasting money was to spin out investment.

On the last point the railways—and the electrical industry—received one crumb of comfort: the announcement by the Minister that the London-Midland Region electrification should go ahead as quickly as was consistent with the best use of resources. This did not mean that Government approval of other main-line electrification works would necessarily be given. Mr. Marples is never happy speaking about the railways, whose " pin-up boy " he hardly is. On this occasion he was recovering from 'flu and was, in consequence, even less informative than usual. He told the House nothing new and did nothing to deflect the barrage of criticism that the White Paper received from all sides of the House. In fact Mr. James Callaghan, winding up for the Opposition, said there had been only one-and-a-half speeches in support of the Government: the half being Sir Toby Low.

### Minister's Responsibilities

No doubt Sir Toby feels in a dilemma arising out of his dual functions as chairman of the Select Committee on Nationalised Industries, whose report has embarrassed the Government, and as deputy chairman of the Conservative Party. On this occasion he supported the view that the Minister of Transport should be openly responsible to the House of Commons for, and have authority over, the co-ordination of transport policy. He went on, however, to say that there must be a much clearer definition of the distinct responsibilities of the Minister and of those operating the nationalised industries. He then dealt with the uneconomic services of the railways and said that the Government should decide the future size and shape of the railway system and the Minister should agree in advance for each year or period of years how much the Exchequer would pay for services which would not be run on purely economic grounds.

In opening for the Opposition Mr. George Strauss said that there was a large measure of agreement on the proposals for the reconstruction of the capital structure of the British Transport Commission, but this would not solve the problem. The country had been lulled into complacency by the optimistic forecasts of the Commission, which, so far as anybody outside knew, the Government had accepted. The question had to be asked whether, in conditions of unrestricted road competition the railways could ever pay their way. Governments in other countries had faced this question. In West Germany and France decisions had been taken to restrict the free competition of road transport so as to induce certain traffic to go by rail. If the Government persisted in allowing unrestricted competition they would have to subsidise the railways permanently out of public funds.

Mr. Strauss said that the Minister had not told the House why it was thought necessary to abolish the British Transport Commission. The Select Committee had said that the general lines on which the Commission were now working were right. On the regional boards he said that there was no function for the proposed full-time members. All they could do was to get in the way of the general managers. This was a thoroughly bad proposal which Mr. Strauss suggested stemmed from the Prime Minister's recollection of his activities on the Great Western Railway Board long, long ago when conditions were very different. He reminded the Prime Minister that when the railways were in private hands there were no full-time directors of any of the railway companies except managing directors.

Mr. Strauss asked the Minister whether the new Railways Board would be responsible for standardisation and bulk purchase, to which no answer was given. He pointed out the inconsistency between the White Paper, which stated that the Railways Board would be responsible for determining the future size and shape of the railway system, and the Minister's statement that it was he and his special study group who were going to decide the size and shape of the future system. The House ought to know where the responsibility would lie.

### "Sham Co-ordination"

The fundamental defect of the White Paper proposals was the threatened break-up of the integrated system under the authority of the Commission. The total inadequacy of the National Transport Advisory Council, which the Government proposed to set up to replace it, was obvious. Integration was to be replaced by sham co-ordination. How could this important task be done by five gentlemen without staff, in the time they could spare from the chairmanship of the five important new boards? Who would take decisions arising out of their advice? Was it proposed to set up the large staff in the Minister's department necessary to carry out such work? To these important questions also no answers were given during the course of the debate and they must, presumably, await the necessary legislation. But on that point the Minister had said that the Bill to implement the White Paper provisions would not be available until next session. The resulting insecurity in the minds of those responsible for running the publicly-owned transport services could not help having grave adverse effects, particularly when the modernisation plan was in such a critical stage. Meanwhile Mr. Strauss hoped that there would be no further interference by the Government in the affairs of British Railways which would have the same harmful effects as most of their interferences in the past. He did not know what damage was done not only to British Railways but also to the heavy electrical industry by the recent hold-up in the Crewe-London part of the London-Midland electrification scheme. He hoped that, before bringing their Bill to Parliament, the Government would think again.

A depressing footnote to the debate was given in an answer to a question later in the week. The Minister said that he had not yet approved the capital expenditure needed for the new railway research laboratories at Derby, the building of which was approved by the Commission in 1959. Discussions are taking place between the Commission, the Department of Scientific and Industrial Research and the Ministry of Transport about this proposal and its relation to other research activities. Meanwhile the small but first-class little team at Derby will struggle on in cramped and unsuitable premises to cope with the horde of problems thrown up by the technological revolution of the modernisation plan. In the words of the cartoonist—"What a way to run a railway."

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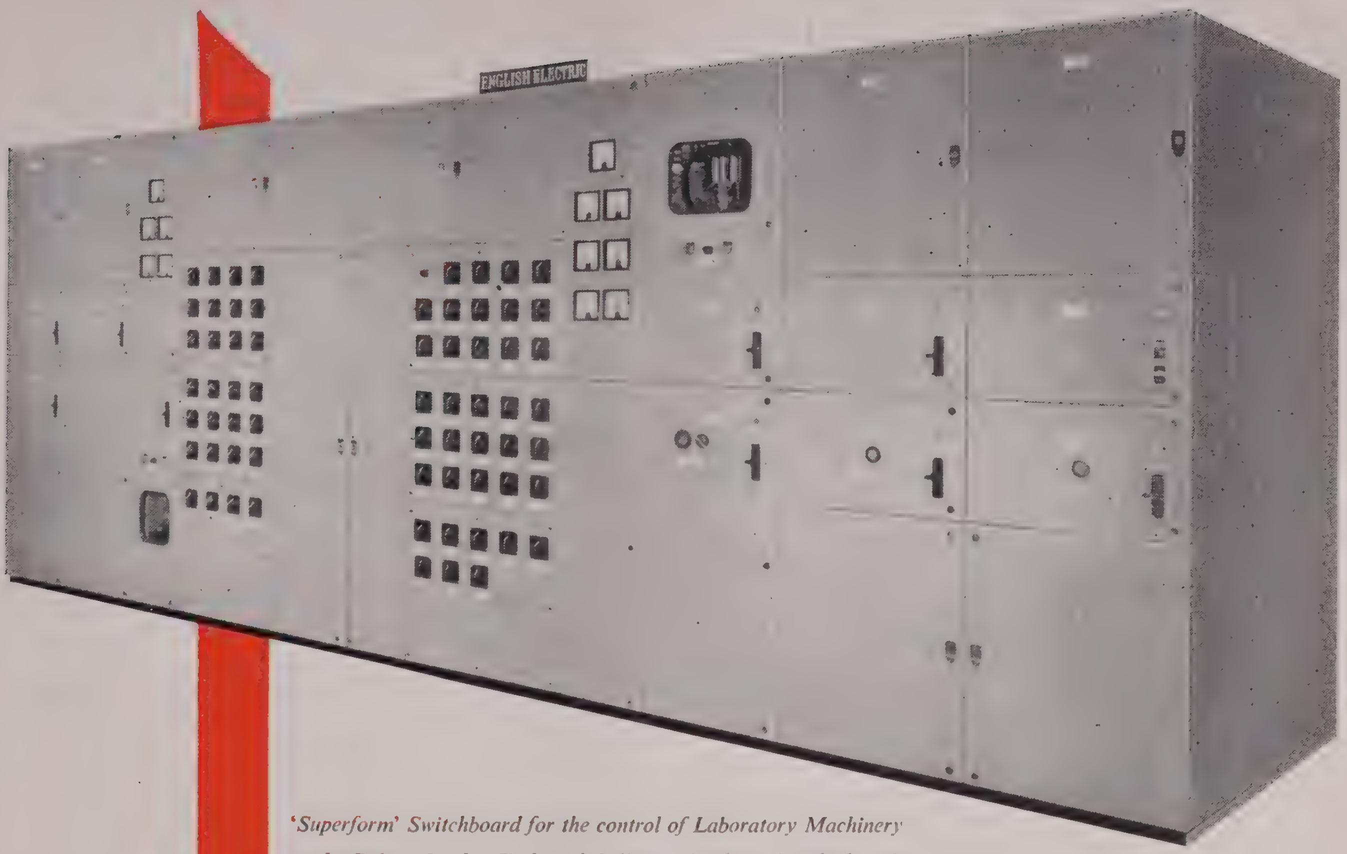
## HIGH-VOLTAGE INSULATORS

THE two British Standards, B.S. 137:1960, "Porcelain and Toughened Glass Insulators for Overhead Power Lines (3·3 kV and upwards)," and B.S. 3297:1960, "High-Voltage Post Insulators," are closely related and have both been drafted to take full advantage of recent international work on the standardisation of high-voltage insulators. The new edition of B.S. 137 is a revision of the 1941 edition. It incorporates the addendum of 1946, in which insulator pins were standardised, and extends the range of standard string insulator units up to a specified minimum failing load of 42,000 lb. The test requirements are closely in line with those of Publications 75 and 87 of the International Electrotechnical Commission, which deal respectively with porcelain and glass insulators. The designs of ball-and-socket couplings have been revised and are now the same as those recommended in I.E.C. Publication 120. This change, while maintaining interchangeability with existing British designs, ensures complete interchangeability with string insulator units made in any of the principal manufacturing countries.

The second standard, B.S. 3297, provides a specification for porcelain and toughened glass post insulators for the same voltage range as that covered by B.S. 137. The insulators specified in B.S. 3297 are designed to give rigid support to busbars, isolators and air-break switch parts in substations, and for similar applications. Mechanical and electrical tests are included to ensure that the insulators are suitable for these duties. The specification is closely in line with B.S. 137, B.S. 223, "High-Voltage Bushings," and the draft recommendations of the I.E.C.

Copies of these standards, B.S. 137 price 15s and B.S. 3297 price 10s, may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1.



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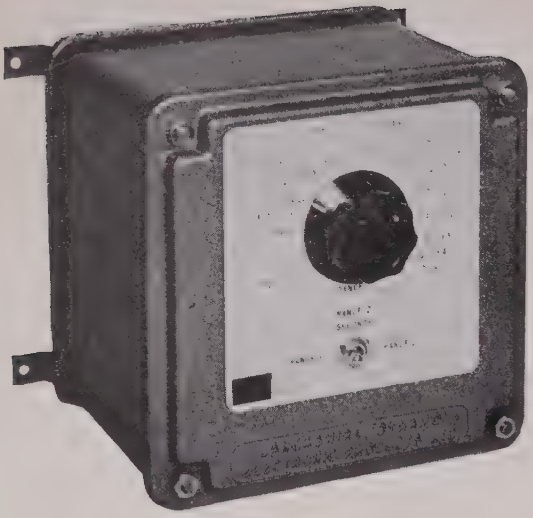

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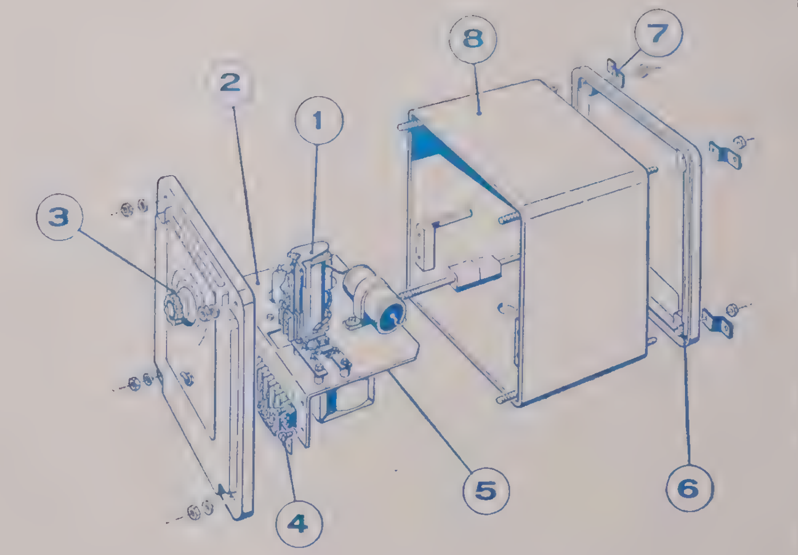

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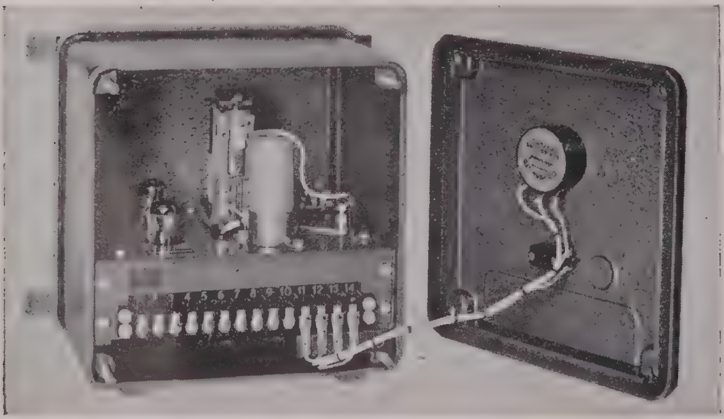

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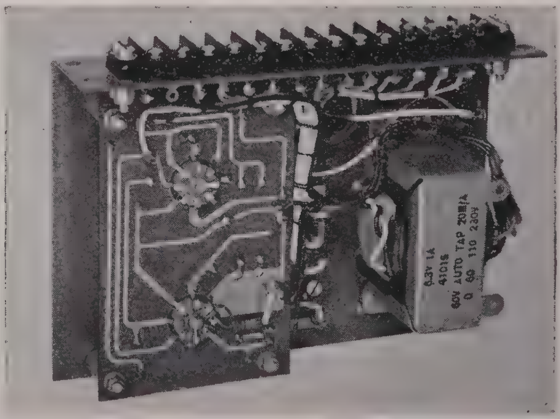

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# LETTERS TO THE EDITOR

*Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.*

## Ship-Shore Supplies

"REFLECTOR," in his "Views on the News" of 27th January, refers to emergency electricity supplies from ships to support a local power shortage on land.

Towards the end of the second world war I was very closely concerned with the operation of two floating power stations which gave succour to the battered Belgian electrical network. These two vessels, *Resistance* and *Sea Power,* were constructed in the United States and were equipped with steering machinery, but no propulsion, having to be towed across the Atlantic by tugs to their berths at the power stations of Langebrugge (Ghent-Terneuzen Canal) and Schelle (River Scheldt) respectively.

Each was equipped with a 30 MW hydrogen-cooled turbo-alternator and carried an operating crew of 50. Unfortunately, being constructed to American standards, they were designed for a frequency of 60 c/s. However, we introduced a step-up rotary frequency convertor in each (for the auxiliaries) and dropped the speed to give a frequency of 50 c/s. They carried a large part of the Belgian base load for very many months and helped to restore the electrical well-being of the country during a melancholy period.

*London, W.6.* D. Winton Thorpe.

I WAS interested to read the "Views on the News" by "Reflector" in your issue of 27th January, especially so when he says that the Stavanger Town Council have rejected the proposal to hire the *Beaver Dam* for lighting the town.

May I point out to you that the *Beaver Dam* is a tanker and, according to Lloyd's Shipping Register, belongs to the Deep Sea Shipping and Charter Company of Panama. We have several "Beaver" cargo liners of approximately 10,000 tons gross; they are as follows:—*Beaverlake, Beaverglen, Beavercove, Beaverdell* and *Beaverford.*

*London, W.C.2.* A. E. J. Grinyer,
*Press Representative,*
Canadian Pacific Railway Co.

## Consumer Protection

THE proposed legislation on consumer protection and home safety prompts me to comment on our general approach to "safety" which, in my view, often produces the very opposite result to that intended. Let me give two examples.

The provision of crash helmets for the greater safety of motor cyclists, whilst saving some cracked skulls, often promotes a false sense of safety and encourages yet higher speeds, and does nothing to secure other road users from the consequences. Similarly, friends of mine are fitting safety belts in their cars because of near misses they have had whilst driving at high speeds. The availability of the safety belt seems to make it unnecessary for them to consider the intelligent alternative of driving less fast, and so take into account the safety of other road users, as well as their own.

And now we are all to be "protected" by legislation aimed at the qualitative control of some of the purchases we make. Whilst there are undoubtedly some articles which will thereby be improved and made more safe, there are certain domestic electrical appliances concerning which a dangerous and false sense of security might well be created. No matter how well such equipment is designed and made, the safety of the consumer in *using* it depends entirely on other factors which are not subject to any legislation, viz.:—

1. The safety of the electrical installation into which the appliance is connected. Any Tom, Dick or Harry —or "Charlie"—can, and does, carry out highly dangerous wiring with impunity.
2. The proper *use* of equipment. For example, not using portable equipment in bathrooms, etc.
3. The proper *maintenance* of equipment, with particular regard to worn flexes, connectors and broken earth wires.

The lay person may be dangerously misled unless consumer protection legislation takes such factors as the foregoing into proper consideration.

I would suggest that it might be helpful to make available certain kinds of domestic electrical appliances under "hire maintenance" arrangements, instead of hire-purchase arrangements, as this could put a responsibility on to organised electrical retailers which they may willingly accept and, in so doing, give the consumer real protection, at economical and competitive prices, throughout the life of the equipment which he uses.

*London, E.C.4.* J. Mortimer Hawkins,
*Managing Director,*
Mortimer, Gall & Co., Ltd.

## Survival of the Fit

TWENTY-FIVE years ago we supplied an electric trawl winch for the French trawler *Mercedita.* The vessel has now passed into Greek hands and the new owners have asked for a wiring diagram.

Ordinarily this would not surprise us, but we are informed that the vessel was sunk three times during the war. The letter adds: "The equipment is all in very good condition."

We are used to making marine electrical equipment that outlasts the ship, but after three sinkings we really think we might expect an opportunity to quote for replacements! All we get out of this performance is a request for a wiring diagram (with which we shall send a copy of "Instructions for Drying-out Electrical Equipment," for possible future use).

*London, W.C.2.* T. J. Barfield,
*Publicity Manager,*
Laurence, Scott & Electromotors, Ltd.

# PERSONAL AND SOCIAL

## *News of Men and Women of the Industry*

**Mr. E. F. Coppock** has been appointed group financial controller to Metal Industries, Ltd. He succeeds **Mr. P. Jardine,** who is taking up full-time directorships with J. G. Statter & Co., Ltd., and Minerva Mouldings, Ltd., two M.I. subsidiaries.

**Mr. J. M. Paul,** M.I.E.E., has been appointed managing director of Foster Transformers, Ltd., and Lancashire Dynamo Nevelin, Ltd., both of which are in the Metal Industries Group, and **Mr. Humphrey Bott,** M.I.Mech.E., M.I.Mar.E., becomes chief engineer of Fawcett Preston & Co., Ltd., another M.I. subsidiary. Mr. Paul received his technical education at Faraday House, London, and after service in the Royal Engineers from 1939 to 1946 he was employed by the Central Electricity Board. From 1949 to 1957 he served with the Uganda Electricity Board. He then went to Zanzibar to set up the Zanzibar Electricity Board, of which he has since been chief engineer and manager. Mr. Bott served in the Royal Navy from 1925 until 1955 when he retired with the rank of commander. He was subsequently with the National Coal Board and John Summers & Sons, Ltd.

*Mr. E. F. Coppock*

*Mr. J. M. Paul*

**Professor H. O'Neill,** head of the Department of Metallurgy, University College of Swansea, University of Wales, has been elected president of the Institute of Metals. The **Earl of Verulam,** chairman of Enfield Rolling Mills, Ltd., is senior vice-president for 1961-62, and **Mr. W. F. Randall,** deputy chairman and managing director, Telcon Metals, Ltd., has also been elected a vice-president.

The British Broadcasting Corporation announces the appointment of **Mr. J. B. Webb,** A.M.I.E.E., as head of the Valve Section of the Transmitter Department in succession to **Mr. H. S. Walker,** M.B.E., A.M.I.E.E., who has retired after nearly 38 years' service. **Dr. R. D. A. Maurice,** A.M.I.E.E., has been appointed assistant head of the Research Department in succession to **Mr. A. B. Howe,** O.B.E., M.Sc., M.I.E.E., who recently retired after 36 years' service with the Corporation.

**Mr. A. D. Lidderdale,** M.I.Mech.E., M.I.Prod.E., has been appointed general manager of Leybold-Elliott, Ltd., the company which was recently formed by Elliott Brothers (London), Ltd., and Leybold's of Cologne. Mr. Lidderdale, who is 46, joined the Telegraph Construction & Maintenance Co., Ltd., in 1953 and was at one time chief engineer and manager of their Mechanical Engineering Division. He later occupied a position on the Cables Group Board and was deputy to the managing director.

**Mr. D. H. Parry,** B.Sc., M.I.E.E., manager of the Leicester Sub-Area of the East Midlands Electricity Board, is retiring on 31st March and will be succeeded by **Mr. D. C. Whyte,** A.M.I.E.E., at present deputy sub-area manager. In the Lincolnshire Sub-Area, **Mr. W. W. Grimes,** M.I.E.E., is relinquishing his position as manager of the Lincoln District on 31st March to become deputy sub-area manager.

Mr. Parry received his early training with Willans & Robinson, Rugby, and became chief contract engineer with the English Electric Co., Ltd. In 1928 he was appointed constructional engineer with the Leicester Corporation Electricity Department and three years later he became chief assistant engineer in charge of the operation of the local generating station and of the distribution system. He took up his present appointment in 1948. He was chairman of the East Midlands Centre of the Institution of Electrical Engineers for the 1959-60 session.

Mr. Whyte, who started with the Derbyshire & Nottinghamshire Electric Power Co., was appointed assistant manager of the Leicestershire & Warwickshire Electric Power Co. in 1946 and became manager of the East Midlands Board's Loughborough District at vesting date. He remained in that capacity until taking up his present appointment in 1958.

*Mr. Charles F. Dickson, O.B.E., who, as we reported last week, has been appointed a vice-chairman of Crompton Parkinson, Ltd.*

After training with Hunter & English, Ltd., Mr. Grimes joined the West Ham Electricity Department in 1928. In 1941 he was appointed a senior technical assistant with the Chesterfield Corporation Electricity Department and was promoted to engineer and manager in 1943. At vesting date he became manager of the Board's Chesterfield District, and in 1958 he took up a similar position in the Lincoln District.

The annual apprentice prize-giving and exhibition of work of **George Kent, Ltd.,** was held on 23rd January at Biscot Road Works, Luton, when the awards were presented by the chairman of the company, Commander P. W. Kent, R.N. The guest speaker was Mr. W. F. Stephenson, B.Sc., F.R.I.C., principal of the Luton College of Technology.

**Mr. E. E. Caffyn,** B.Sc.(Eng.), of Power Rectifier Sales Department, A.E.I. Heavy Plant Division, Rugby, retired on 31st January after more than forty-eight years' service. After taking the B.Sc.(Eng.) degree at King's College, London University, Mr. Caffyn joined the British Thomson-

*Mr. D. H. Parry*

*Mr. D. C. Whyte*

*Mr. W. W. Grimes*

Houston Co., now A.E.I. (Rugby), Ltd., in 1912, in the Test Department and subsequently held positions in various departments of the company. Since 1927-28, when the company began to manufacture rectifiers, Mr. Caffyn has handled, among others, the contracts for the rectifier substation equipment for the Cockfosters extension to the London Electric Railway; for the Western extension to the Central London Railway; and for mechanical rectifiers supplied to I.C.I.

**Mr. L. C. Penwill,** C.B.E., Companion I.E.E., director of the Electrical Contractors' Association (Incorp.), the National Federated Electrical Association, and the N.E.C.T.A., Ltd., is to retire in February next year, when he will have served the Association for upwards of 41 years. Mr. Penwill joined the staff of the three Associations as assistant secretary in 1920, under the then chief executive official, Mr. L. G. Tate. On the death of Mr. Tate in 1926, Mr. Penwill was appointed to succeed him.

**Mr. F. C. Pullen** (sales manager), **Mr. G. O. Collier** (works manager) and **Mr. E. Walley,** F.C.A. (company secretary), have been appointed to the board of Ekco Plastics, Ltd.

**Mr. R. M. I. Hobill** is joining the board of Ferranti, Ltd. Mr. Hobill started with the company in 1929 after training with Sir W. G. Armstrong Whitworth & Co., and worked successively in the transformer drawing office; on the supervision of outside erection both home and overseas; and on technical sales until 1940, when he was appointed transformer works manager. In 1946 he became sales manager, London Area; in 1951 he returned to Hollinwood as sales manager, Transformer Department, and was appointed manager of that department in 1958.

*Mr. R. M. I. Hobill*

Two new sales positions have been created at the M-O Valve Co., Ltd., Hammersmith, a subsidiary of the General Electric Co., Ltd. **Mr. N. Girton** has been appointed manager—home sales and **Mr. C. R. Russell** manager—export sales.

**Mr. K. R. Simmonds,** B.Sc.(Eng.), A.M.I.E.E., has been appointed managing director of the International Rectifier Co. (Great Britain), Ltd., a company owned jointly by Metal Industries, Ltd., and the International Rectifier Corporation of Los Angeles. Mr. Simmonds, who joined the company in 1959 as general manager, has been associated with the semiconductor industry for some time, having previously been with Texas Instruments, Ltd., as general manager, marketing. Before that he was manager of the Radar Division of Elliott Bros. (London), Ltd.

*Mr. R. H. Jeffery*

*Mr. J. A. Barson*

*Mr. B. E. Shea*

**Mr. J. Y. McDonald** has been appointed manager—diesel engines, at the Preston works of the English Electric Co., Ltd. He succeeds **Mr. J. H. A. Sharpley,** who is undertaking other duties.

**Mr. F. J. Newman,** A.M.I.E.E., has just retired from Pritchett & Gold and E.P.S. Co., Ltd., after over 40 years' service, and at a recent staff gathering at the Dagenite Works a presentation was made to him by the company's sales manager, Mr. E. J. Roberts. Mr. Newman was closely associated with the design of the closed top type cell.

**Mr. John Creek** has been appointed deputy managing director of Fibreglass, Ltd., in addition to his present appointment as sales director.

**Messrs. T. Blackshaw** (Blackburn), **H. Featherstone,** A.M.I.E.E., and **J. Walsh,** Associate I.E.E., have been elected Fellows of the Electrical Contractors' Association.

**Mr. W. Steer,** Croydon area sales superintendent of the A.E.I. Lamp & Lighting Co., Ltd., has retired after 40 years in the electrical industry.

**Mr. R. W. Chapman,** Graduate I.E.E., has joined the Electric Construction Co., Ltd., as senior sales engineer, Yorkshire Area, and he will work from the Leeds office. Mr. Chapman was previously with the English Electric Co., Ltd., and the Lancashire Dynamo Group.

*Mr. R. W. Chapman*

**Mr. R. H. Jeffery** has been appointed general sales manager of A.E.I.-Hotpoint, Ltd., in succession to **Mr. J. M. Donald,** who is undertaking special duties with Hotpoint's associated export company, A.E.I.-Gala. Mr. Jeffery is succeeded as southern division sales manager by **Mr. J. A. Barson** and **Mr. B. E. Shea** becomes London district sales manager.

**Mr. R. H. Newton,** who has been appointed works director of Aberdare Cables, Ltd., was with the Macintosh Cable Co. for 15 years and afterwards served with British Insulated Cables for a short period before going to South Wales as one of the first employees of Aberdare Cables when the factory was built in 1937-38; he has held an executive position in the company ever since and was appointed to the board in 1955.

*Mr. R. H. Newton*

*Mr. N. Care*

**Mr. Norman Care,** M.I.E.E., general manager of South Wales Switchgear, Ltd., has undertaken the additional duties of co-ordinating the sales organisation of home factories in the Aberdare Holdings Group. Mr. Care joined South Wales Switchgear in 1954 and became general manager in 1957. Before moving to South Wales, he was assistant chief engineer of the Midlands Electricity Board, having previously been technical engineer with the Birmingham Electric Supply Department. He is immediate past-chairman of the Supply Group of the I.E.E. Western Centre and co-author of an I.E.E. paper on automatic circuit reclosers.

**Mr. E. A. E. Colter** has retired from the position of establishments officer to the Merseyside and North Wales Electricity Board on account of ill-health. For 30 years Mr. Colter was on the staff of the former Lancashire Electric

Power Co. and he became establishments officer to "Manweb" in 1948 when the electricity supply industry was nationalised.

**Mr. B. W. Ricks**, M.I.E.E., has been appointed deputy chief engineer of the Eastern Electricity Board in succession to **Mr. E. P. Burdett,** who is due to retire later this year. Mr. Ricks, who is at present engineer of the Northmet Sub-Area, will also become the Board's operational research engineer. He was with the Plymouth electricity undertaking for 20 years and was concerned with the maintenance and restoration of electricity supplies during enemy air attacks on the city. In 1949 he became deputy engineer of the Torbay and West Devon Sub-Area, South Western Electricity Board, moving to the Bristol and North Somerset Sub-Area eighteen months later as planning and development engineer until 1955, when he was appointed an assistant chief engineer of the Board. He joined the Eastern Electricity Board in 1957.

*Mr. B. W. Ricks*

**Mr. W. Newcome-Baker,** King's Lynn, has been re-appointed a part-time member of the Eastern Electricity Board. **Mr. J. E. N. Davis** is retiring from part-time membership of the Board at the end of this month.

**Mr. R. F. Richardson,** M.B.E., M.I.E.E., has been appointed a member of the South Western Electricity Board for three years from 1st May. Mr. Richardson has been the Board's chief commercial officer since 1957. After training with Callender's Cable & Construction Co. he joined Central London Electricity, Ltd., as a senior sales engineer in 1936. During the 1939-45 war he commanded a Field Park Company, R.E., throughout the N.W. European campaign and was made an M.B.E. He was later with the London Electricity Board and he became assistant commercial manager of the British Electricity Authority in 1953. Mr. Richardson has for some years been engaged in utilisation research and in economic studies affecting the development of electricity. He was for a time the United Kingdom delegate on an O.E.E.C. group of experts dealing with electricity prices.

*Mr. R. F. Richardson*

The Minister of Power has also appointed **Alderman S. H. Payne,** J.P., to be a part-time member of the South Western Board for a further period of two years from 1st April. Ald. Payne was formerly district secretary of the Amalgamated Engineering Union, Taunton, and he was Mayor of Taunton in 1945-46. **Sir George Turner,** K.C.B., K.B.E., is retiring from the Board on 30th April.

**Mr. C. Bottomley** has been appointed manager of the Time Systems Division of IBM United Kingdom, Ltd., in succession to **Mr. E. Stafford Howard,** who is retiring.

**Mr. Robert Appleby** has been elected executive vice-president — European operations of the Black & Decker Manufacturing Co., U.S.A. Mr. Appleby is managing director of the British associate company, Black & Decker, Ltd., Harmondsworth, Middlesex, and a director of Black & Decker subsidiaries in Belgium, West Germany and the Netherlands.

*Mr. R. Appleby*

**Mr. M. R. Symonds,** A.C.A., and **Mr. R. H. Symonds** have been appointed directors of R. H. Symonds, Ltd., and Symonds & Sons, Ltd.

**Mr. C. G. Kneller** has been appointed advertising and sales promotion manager of the British Divisions of the Yale & Towne Manufacturing Company.

**Mr. G. S. Bone** has joined Denham & Morley, Ltd., as sales promotion manager of the Scharpf Division, which includes washing machines, spin dryers and refrigerators.

## OBITUARY

**Mr. A. W. C. McArthur.** — The death occurred on 28th January of Mr. A. W. C. McArthur, M.I.E.E., a former member of the board of W. T. Henley's Telegraph Works Co., Ltd. (now part of Associated Electrical Industries, Ltd.). He was 75. Mr. McArthur was with Henley's for over 58 years, becoming manager of the Woolwich Works in 1939, a position which he occupied for thirteen years. In addition he was works manager of the Birtley Works from the time of its opening in 1950 to 1952. He was elected to the board in 1950, retiring in 1958.

**Mr. Leslie Parsons,** who was appointed a member of the South Wales Electricity Board on 1st March, 1948, and had served continuously since then, died on 22nd January.

**Mr. Andrew Young,** formerly chief draughtsman, London Division, Central Electricity Generating Board, died on 4th February.

**Mr. W. G. Heath,** M.I.E.E., who has died at the age of 82, was a pioneer of the electrical industry in the South-West. He started the business of W. G. Heath & Co. at Plymouth in 1898 and carried out some of the earliest electric lighting installations in the city. He was a director of a number of companies, including Rediffusion, Ltd., and Britannic Cables, Ltd., and was a Fellow of the Electrical Contractors' Association.

**Mr. James M. Barker,** formerly district commercial engineer, Morpeth, with the North Eastern Electricity Board, has died after a short illness. He retired about 18 months ago after 35 years in the electricity industry.

**Mr. Alfred A. Anderson,** who retired from the position of assistant district engineer for the South Angus District of the North of Scotland Hydro-Electric Board in August, 1959, died on 28th January at the age of 66.

## WILLS

**Mrs. S. G. Brown,** co-founder with her husband, the late Mr. S. G. Brown, F.R.S., M.I.E.E., of S. G. Brown, Ltd., and a niece of the late Professor John Perry, F.R.S., who died on 22nd November last, left £311,140 gross (£304,802 net).

**Mr. C. F. Jackson,** J.P., a director of Lancashire Dynamo & Crypto, Ltd., and general manager of its Willesden factory, who died on 27th October last, left £9,445 gross (£6,834 net).

**Mr. Harry Moss,** M.I.E.E., formerly for many years an electrical contractor at Bradford, who died on 20th November, left £3,962 gross (£3,892 net).

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## A.S.E.E. Annual Dinner

The annual dinner of the Association of Supervising Electrical Engineers will be held at Grosvenor House, London, W.1, on Friday, 7th April, when the guest speakers will be Lord McCorquodale of Newton, P.C. (president, British Employers' Confederation), Lord Coleraine, P.C. (chairman, National Youth Employment Council), and Sir Hamish MacLaren, K.B.E., C.B. (President, Institution of Electrical Engineers). Applications for tickets (£2 2s each) should be sent to the General Secretary, A.S.E.E., 23, Bloomsbury Square, London, W.C.1.

## INDUSTRIAL NEWS

# SPACE CONSORTIUM FORMED

THE formation by eight leading industrial firms of the British Space Development Company has been described as a free-enterprise "spring-board into space." The new organisation brings together "a representative cross-section of that part of industry which is interested in the development and exploitation of space for commercial purposes."

The eight participating companies, who believe that it will not be long before they are joined by others, are Associated Electrical Industries, Associated Television, British Insulated Callender's Cables, Decca Radar, de Havilland, Pye, the Rank Organisation, and Rolls-Royce.

In its articles of association the aims of the new company are listed to include scientific research, investigation of outer space, the propulsion and direction of vehicles, missiles and artificial satellites within the atmosphere and stratosphere, the employment of satellites in telecommunications, and the pursuit of any other science thought to be ancillary to the objects of the company. The initial capital of the company is limited to £20,000. The more modest first aim is to be an agency to represent industry in any talks, either in the Commonwealth or which include European participation, concerning a Government space programme.

Sir Robert Renwick said at a Press conference: "We who have formed this company believe the money in space is more than any man ever dreamed of. It is colossal. We believe the gentlemen adventurers of space have a much bigger chance of vast wealth than ever did the adventurers of the Hudson's Bay Company or the East India Company. It is the real Eldorado of the future. If we are not in space, London ceases to be the centre of the world as far as communications are concerned."

### INCREASED ELECTRONIC EXPORTS

The electronic industry's exports—about £28 million worth last year—are estimated to be five times more than ten years ago, according to Mr. L. T. Hinton, chairman of the Electronic Engineering Association. Mr. Hinton said that this had been achieved in face of severe competition, which was not always strictly economic.

The estimated gross output of the capital goods side of the electronic industry was about £175 million, more than two-and-a-half times that of a decade ago. Electronics was the most forward-looking industry in this country. We had held our leading place in communications, which was the foundation of the industry, and in radar, which was invented in this country. We were the leading exporters of broadcasting transmitters, cameras, studio equipment, outside-broadcasting units and so on. In the industrial field, we were selling machine-tool control equipment to many countries, including the United States, and we had made notable advances in recent years in the design and application of computer systems.

# Railway "All Clear" Welcomed

IN a joint statement, the British Electrical and Allied Manufacturers' Association and the Locomotive and Allied Manufacturers' Association of Great Britain comment on the Government's announcement that the London-Midland electrification scheme is to be allowed to proceed. The Associations welcome the decision and the Government's expression of confidence in the British manufacturing industry which will give impetus to export trade. The manufacturers and contractors fully support the British Transport Commission's estimate that the technical, manufacturing and constructional resources are available to achieve completion by 1966.

The industry is however disturbed that despite several months' consideration the Government is still unable to give a clear indication of future policy regarding the modernisation programme as a whole. There is still no authorised capital investment beyond 1961, for which the authorised expenditure is already committed by existing orders. In order to use the resources of British industry to best advantage a long-term investment programme is essential. By its very nature railway equipment production has to be planned well ahead. The manufacturers therefore urge on the Government the necessity for giving early authorisation to the further modernisation proposals which are essential to secure the full benefits of improved services and increased traffic.

### "SIMA REVIEW"

The first number of the new *SIMA Review* has just been published by the Scientific Instrument Manufacturers' Association. It replaces the former *SIMA Bulletin* which was largely concerned with the internal matters of the Association. The new journal, which costs 7s 6d per copy, will appear twice a year and is considerably larger than its predecessor.

# *Switchgear for Railway Electrification*

*Work proceeding during the early hours of Sunday morning, 29th January, unloading and erecting, alongside a busy railway track at Shadwell, a 33 kV ring main unit by a South Wales Switchgear team. The work, part of the electrification of the Eastern Section of British Railways, began at 12.45 a.m. and was completed by 7 p.m. the same day, ready for commissioning tests*

# American Price Fixing Case Sentences

FINES totalling £120,000 were imposed on eight of America's largest electrical manufacturing companies in Philadelphia on Monday on the first two of 20 charges of price fixing in violation of anti-trust laws. Four senior officials were each sentenced to 30 days' imprisonment and they and other individual defendants were fined a total of nearly £14,000. The judge, Mr. J. Culley Ganey, described the whole case against the companies and a number of individual executives as "a shocking indictment of a vast section of our economy." The defendants had "mocked the image of the American free enterprise system," he said.

The first two counts involved the sale of transformers and switchgear. The defendant companies all pleaded "Guilty." The companies fined included General Electric, Westinghouse, Allis-Chalmers Manufacturing, McGraw-Eidon, Moloney Electric, Wagner Electric, Federal Pacific and I-T-E Circuit Breaker. Those sentenced to imprisonment were Mr. J. H. Chiles, a Westinghouse vice-president; Mr. W. S. Ginn, General Electric vice-president; Mr. Lewis Burger, a former manager of the General Electric's Power Switchgear Division; and Mr. George Burens, a General Electric vice-president who preceded Mr. Burger in the Switchgear Division. The judge delayed the start of the gaol terms until next Monday.

The indictments in the case cover a period from 1955 and extending almost to 1960. They involve a gross annual business of £714 million for equipment used in the generation, transmission and distribution of electric power.

## PRODUCTION CONFERENCE

The Society of Instrument Technology and the Birmingham Productivity Association are to hold a one-day conference at the Birmingham College of Technology on Wednesday, 29th March. The object of the conference, which is aimed at small and medium sized manufacturers, is to show the use of instrumentation in increasing productivity profitably. A concurrent instrument exhibition has also been arranged. Further information and a programme can be obtained from Mr. D. Smith, hon. secretary, Society of Instrument Technology, Midland Local Section, I.C.I. Metals Division, Kynoch Works, Witton.

# Disappointing Year for Domestic Refrigerators

THE Domestic Refrigeration Development Committee reports that deliveries of British-made domestic refrigerators to the home market during December totalled 34,254, a decline of 29 per cent compared with the December, 1959, figure (48,265). The fall was, however, not so sharp as in November, when deliveries were 39 per cent less than a year ago.

Total deliveries of British-made domestic refrigerators to the home market during 1960 were 929,362, compared with 849,362 in 1959. This increase of 9·4 per cent is substantially lower than anticipated by the industry at the beginning of the year, and reflects the harm caused by the reimposition of severe hire-purchase restrictions. In 1959 there was an increase in sales of nearly 100 per cent.

Exports during 1960 were good. December deliveries to overseas markets amounted to 10,453, an increase of 37·7 per cent on December, 1959—7,590. Aggregate exports for 1960 were 136,574, an increase of 42·2 per cent over 1959, when they totalled 95,998.

# Apprentice Training Exhibition

THE first of its kind, an apprentice training exhibition held in the lecture theatre of the Apprentice Training Department, A.E.I. Rugby Works, from 30th January to 3rd February showed not only something of apprentice training methods but also included examples of work done by apprentices. The display was a preview of a similar exhibition which will be staged during Commonwealth Technical Training Week in May, and was designed to stimulate local recruitment.

Coupled with the exhibition, three new apprentice training rooms dealing with craft fitting, craft machining and marking out, and technician and drawing office training, were also open for inspection.

*Visitors to the apprentice training exhibition held at the A.E.I. Rugby Works included teachers from technical colleges and schools*

### Marking of Imported Refrigerators

The Board of Trade has been asked to recommend the making of an Order in Council to require imported goods of the following descriptions to bear an indication of origin at the time of importation, sale and exposure for sale in the United Kingdom:—

(a) Domestic refrigerator cabinets, whether or not incorporating a refrigerating system or part of such system;

(b) Commercial refrigerator cabinets, whether or not incorporating a refrigerating system or part of such system, including deep freeze cabinets, display cabinets, frozen food cabinets, service cabinets, ice cream conservators, display counters and farm freezers.

A public inquiry is to be held and representatives of any interests substantially affected by the application who desire to be heard should write to the Secretary, Merchandise Marks Committee, Board of Trade, Room 1103, Horse Guards Avenue, London, S.W.1, as soon as possible and not later than 17th March.

*At the I.E.E. South Midland Centre dinner: Sir Hamish MacLaren (President), Brig. F. Jones (Centre chairman), the Lord Mayor of Birmingham (Ald. G. B. Boughton), Mr. E. H. Cox, Mr. F. G. Furniss, Mr. H. M. Fricke, Mr. C. F. Partridge, Mr. J. G. Henderson and Mr. J. H. Addenbrooke*

# I.E.E. South Midland Dinner

ON Friday last the South Midland Centre of the Institution of Electrical Engineers held its annual dinner at the Grand Hotel, Birmingham, under the chairmanship of Brig. F. Jones. This year the Centre celebrates its diamond jubilee.

Responding to the toast of the Institution, proposed by the Lord Mayor of Birmingham (Alderman G. B. Boughton), Sir Hamish D. MacLaren, President of the Institution, said that the Centre had within its territory some of the largest firms in the country. The Institution was indebted to all officials of the Centres and Sub-Centres; the amount of time which they put in contributed most materially to the success of the Institution. Sir Hamish also referred to the fact that the I.E.E. was doing its utmost to bring the specialist Sections into line with present-day practice. He then said that the status of the engineer was not in step with his importance to the community. This sometimes made recruiting difficult. Electrical engineering was so wide that there was a perpetual need for an electrical institution. Much could be done however to advance the status of their profession and Sir Hamish hoped that something would come out of the discussions between the presidents of the three major institutions regarding this problem.

The toast to the guests was proposed by Brigadier Jones. During the course of his speech he said that the attendance of some 450 members at this, their diamond jubilee, dinner was the largest number that had ever attended an annual dinner of the Centre. The Centre was 60 years old almost to the day; originally there were 110 members and now there were 4,000. A witty response was made by Mr. E. J. Dodd, Chief Constable of Birmingham.

# British Equipment for Russian Cable Ships

THE Engineering Division of the Telegraph Construction & Maintenance Co., Ltd., a member of the B.I.C.C. Group, has received a contract from Wartsila-Koncernen A/B., Sandvikens Skeppsdocka, Finland, for all the cable handling equipment for two new cable ships they are building for Russia.

The order, which is believed to be the largest ever made for this type of equipment, was secured in the face of keen competition at home and abroad. The vessels are of 7,000 tons displacement and capable of laying and repairing submarine cable systems including all types of submerged repeaters.

The equipment of each vessel, incorporating the latest improvements in submarine cable laying practice, will include two forward picking-up and paying-out gears, draw-off and holding-back gears, dynamometers, bow gear and after laying gear, and all ancillary equipment. The first vessel is required by 1962 and the other is to follow in 1963.

# Dearer Electricity in Jersey

FROM the first meter readings after 30th April most consumers in Jersey will pay more for their electricity. The Jersey Electricity Co. states that the rise has been made necessary because of higher working costs and to cover "charges on new capital"—in December last the Jersey States (the island Parliament) agreed to purchase £450,000 new shares in the company.

Under the new tariff the price per kWh in the primary block will rise from 6d to 7d. In the other blocks the prices will remain at 1·7d and 1·4d per kWh. For domestic users the assessment based on the number of rooms has been increased by approximately 20 per cent. For business premises the primary block assessment will continue to be 20 kWh per 125 W of lighting load and 10 kWh per 500 W or ½ h.p. of other assessed load per quarter. The secondary block is five times the number of primary kWh.

### RESTRICTIVE PRACTICES REPORT

A report on the work of the Registrar of Restrictive Trading Agreements during the period 7th August, 1956, to 31st December, 1959, has been published by H.M. Stationery Office as Cmnd. No. 1273. It deals among other things with the process of registration and the contents of the register; with proceedings before the Restrictive Practices Court (notes on a number of contested cases are given); and with the staffing and organisation of the Registrar's office.

### Lighting in New Shell Building

Shell Petroleum have ordered "Mazda Kolor-rite" fluorescent tubes for their 26-storey London office block on the South Bank site. Some 25,000 3ft and 4ft tubes will be used in 12,000 A.E.I. module fluorescent fittings recessed into Frenger ceilings.

# Supply of Sodium Lamps

IN the House of Commons last week the President of the Board of Trade was asked by Mr. C. F. Grey, Labour member for Durham, if he was aware of the shortage of 140 W sodium lamps for street lighting "arising from the concentration of the lamp manufacturing industry" and if he would refer the industry to the Monopolies Commission. Mr. Grey said that local authorities were finding it difficult to obtain these lamps and the position was aggravated by the fact that the ones that had been supplied were not living out their guaranteed life. Mr. Maudling replied that he would investigate any evidence submitted to him when considering possible new references to the Monopolies Commission.

We understand that last year there was a marked increase in demand for sodium lamps, apparently resulting from a sudden increase in spending by local authorities on the conversion of street lighting schemes to sodium. The largest manufacturers of these lamps, Philips, state that they have considerably expanded their production in recent months and though, like other companies, they are at present dispatching lamps direct from the production line, in about three months' time it should be possible to supply again from stock.

## Nuclear Power Export Prospects

There might soon be opportunities for Britain to sell three more nuclear power stations abroad, the Parliamentary Secretary to the Ministry of Power (Mr. George) said in the House of Commons this week.

Winding up a debate on nuclear power stations, Mr. George said overseas business had not expanded as quickly as expected and the reasons were the same as has led to the stretching out of the programme at home, namely, the disappearance of the coal shortage and the delay in nuclear power achieving cost parity with conventional power.

Two stations had been sold abroad, one in Japan and one in Italy. It was possible that two more might go to India and Brazil might invite a tender this year. In addition, Japan was considering a second station.

# *Higher Charges in North East*

ANOTHER Board—the North Eastern—has announced that its charges are to be raised to meet increased costs. The revised tariffs, which will take effect from the first normal meter readings following 31st March, have been considered and accepted by the Area Electricity Consultative Council.

Under the maximum demand tariffs, on which nearly all industrial consumers are charged, there will be increases in "unit" rates but the kilowatt demand charge will remain unaltered. There will be some increases in commercial tariffs and the opportunity is also being taken to simplify these tariffs.

Domestic tariffs are to be changed by increasing the number of kWh charged at 6d from 11 to 13 per quarter for each assessable room and raising the running charge from 1d to 1·15d.

The Board is offering a further stimulus to the steady growth in off-peak storage heating by reducing the present off-peak rates of 0·75d and 0·85d per kWh to 0·7d and 0·8d respectively.

## Catering Equipment Exhibition

The products of more than 70 companies will be shown at the Hoteliers, Caterers and Catering Equipment Exhibition, which will be officially opened by the Lord Mayor of Birmingham, at Bingley Hall, Birmingham, on Wednesday, 15th February. The exhibition closes on 24th February.

## PRICE INCREASES

A.E.I.-Hotpoint, Ltd., state that in consequence of the recent increase in wages they have had to advance the price of their washing machines by 4 gns. On small appliances there is an increase of approximately 5 per cent.

Atlas Lighting, Ltd., announce that, with effect from 6th February, tungsten filament lamp fittings in the following categories will be subject to price increases of 7½ per cent:—Industrial dispersive fittings; elliptical and parabolic reflector fittings; local lighting reflector fittings; high bay lighting units; blended light fittings; and industrial diffusers. These fittings are not subject to purchase tax.

## NEW ELLIOTT SUBSIDIARY

Elliott Brothers (London), Ltd., a member of the Elliott-Automation Group, announces the formation of a new subsidiary company, Rotron Controls, Ltd., owned jointly with the Rotron Controls Corporation of Woodstock, New York. Elliotts have a two-thirds controlling interest in the new company. Rotron Controls, Ltd., will have its headquarters at the Elliott-Automation factory at Airport Works, Rochester, Kent. It will manufacture the range of flowmeters and associated equipment developed by the Rotron Controls Corporation for positive and mass-flow measurements in the oil, gas, water and petro-chemical industries, and will sell these instruments throughout Europe, the Middle East and the British Commonwealth (except Canada).

## CABLE SHIP MACHINERY

An order worth more than £300,000 for the 6,000 s.h.p. twin screw, diesel-electric propulsion installation in the new cable-laying ship to be built by Cammell Lairds, Birkenhead, for Cable & Wireless, referred to in last week's issue, has been awarded to the English Electric Co., Ltd. It will consist of four 8-cylinder main engines, of the CSRLM type, driving direct current generators arranged in series with the two 3,000 s.h.p., 800 V, 146 r.p.m. main motors. The machinery will be controlled on the modified Ward-Leonard principle from the bridge and other stations. Auxiliary power is to be supplied by two 500 kW generators, tandem driven from the main engines, and two 500 kW auxiliary diesel-driven generators.

## Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

| | |
|---|---|
| ALUMINIUM ingots | ton £186 0s 0d |
| COPPER, H.C. Electro | ton £221 15s 0d |
| Fire Refined 99·70% | ton £220 0s 0d |
| Fire Refined 99·50% | ton £219 0s 0d |
| COPPER Tubes .. | lb 2s 1⅜d |
| Sheet .. .. | ton £255 10s 0d |
| H.C. wire and strip | ton £271 5s 0d |
| LEAD, English .. | ton £64 10s 0d |
| Foreign .. .. | ton £63 0s 0d |
| MERCURY .. .. | flask £69 0s 0d |
| TIN, block (English) .. | ton £787 10s 0d |
| ZINC, G.O.B. Foreign | ton £79 10s 0d |
| BRASS Tubes (solid drawn) .. .. | lb 1s 9d |
| Wire .. .. | lb 2s 7⅝d |
| PHOSPHOR BRONZE Wire .. .. | lb 4s 0⅜d |
| PLATINUM .. | oz £30 5s 0d |
| RUBBER, No. 1 R.S.S. spot .. .. .. | lb 23⅝d—24⅞d |

# FULLY TESTED

# REPEATER UNIT

## for use with the

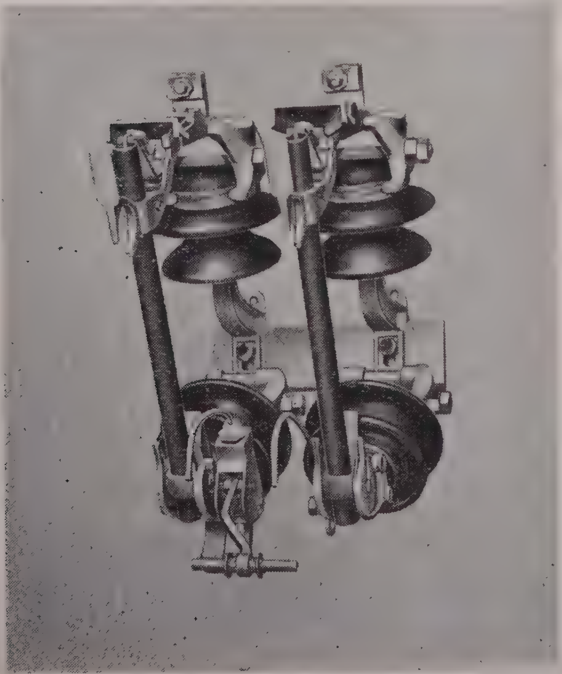
# NEW 150 MVA, 11 kV Type 'D' FUSE-SWITCH

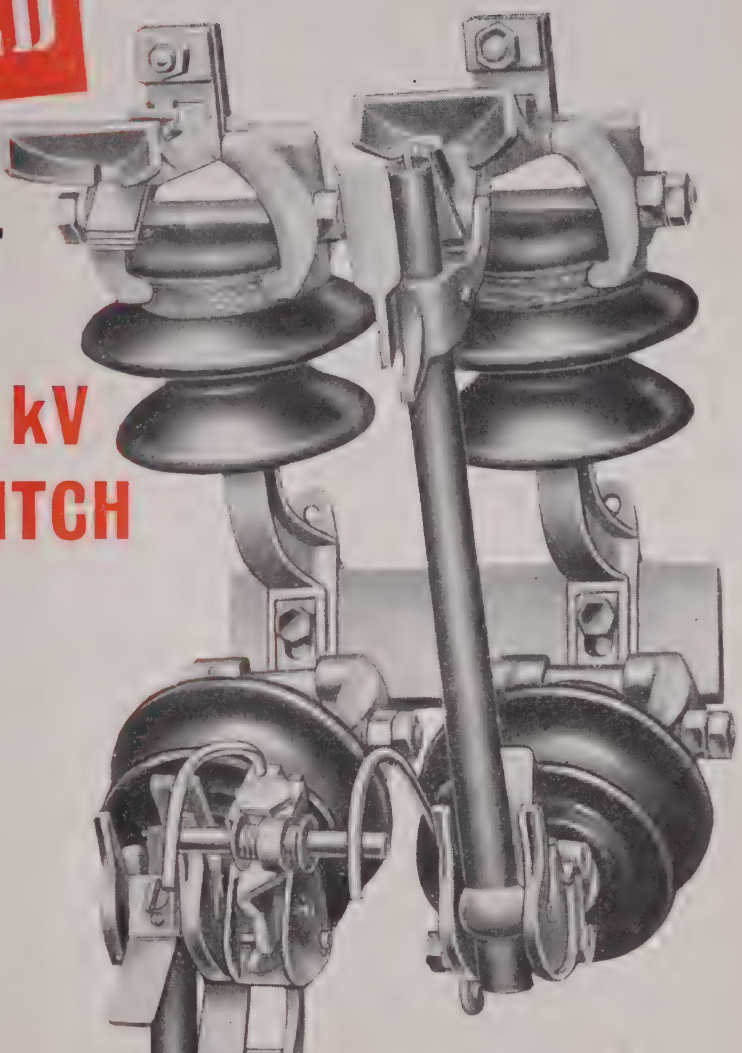
To match the performance of the new Type 'D' Expulsion Fuse-Switch, J. & P. now introduce a repeater unit to provide automatic restoration of overhead line supplies after momentary faults have cleared.

The majority of faults on overhead lines are of a transient nature and the cause is usually destroyed by the resultant power arc. In such circumstances the Repeater Unit will introduce a second expulsion fuse-switch into the circuit, after the first fuse has blown, and automatically restore the circuit. If the fault is sustained, the second fuse will blow.

The Repeater Unit has been thoroughly tested at the C.E.S.I. Laboratories, Milan, for operation at all current values up to 8000 A at 11 kV.

*Further details of the Type 'D' Fuse-Switch and Repeater Unit are available on request.*

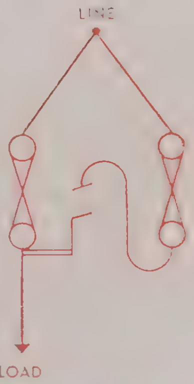




**Left:** *J. & P. Type 'D' Fuse-Switch repeater with both fuses intact and repeater open.*

**Above:** *One fuse blown and repeater closed.*

**Right:** *Diagram of repeater switch connections.*



**JOHNSON & PHILLIPS LTD.**
**CHARLTON · LONDON · S.E.7**

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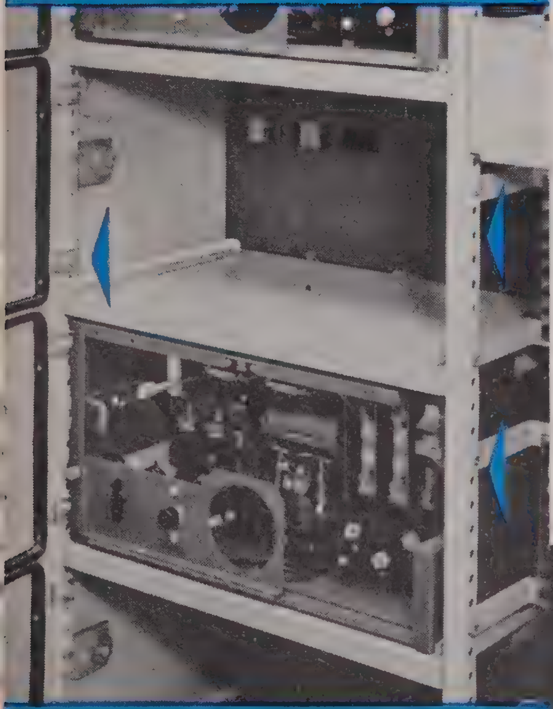
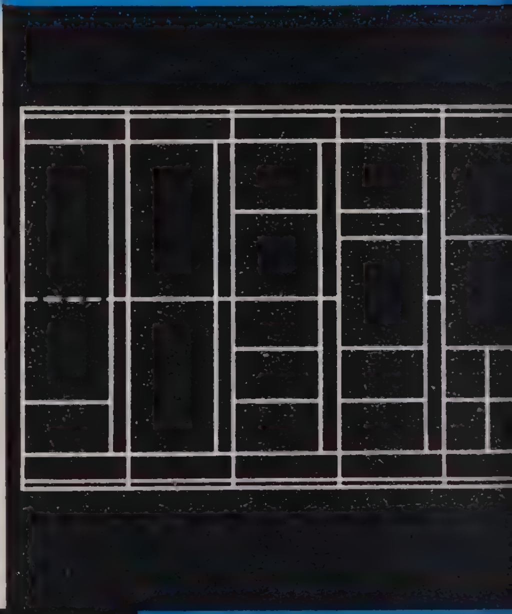
(in association with Balmer, Lawrie & Co. Ltd.)

# ONLY THE G.E.C. MOTOR CONTROL CENTRE HAS SUCH FLEXIBILITY

- Tray sizes are standardised, so that layout can be planned for control boards in early stages of any project without waiting for complete tenders and specifications
- All starter units are interchangeable because of bolted multi-hole construction of cubicle frame (No welding or machining of cubicle is necessary when changing h.p. or motor type)
- Additional starters can be fitted into spare compartments, if necessary, without taking a board off load
- Boards can be supplied in line, back to back or at right angles, to suit control room layout





**In addition the G.E.C. Standard Motor Control Centre gives:**

**EXTRA SAFETY**
All doors interlocked with the unique G.E.C. 3-position isolating switch

**EASY SERVICING**
Self-aligning plug-in system enables easy replacement and servicing of any unit while Centre is in action

**SUCH COMPACTNESS**
18″ deep cubicles save space

**QUICK DELIVERY**
**Within 12 to 16 weeks of order**

Call in a G.E.C. technical representative for further information and advice. (Phone Birmingham East 1941 Extn. 342). Or write for full details to:

## RELY ON THE EXPERIENCE OF G.E.C.

the first Company to make this type of Motor Control Centre in the U.K.

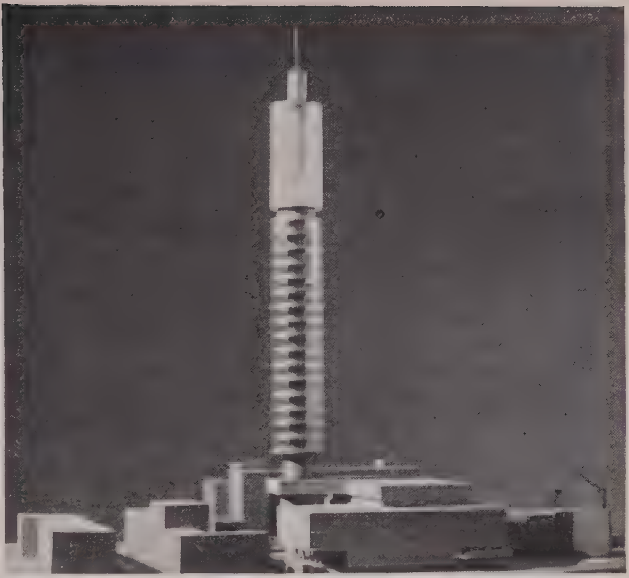
THE GENERAL ELECTRIC COMPANY LIMITED OF ENGLAND SWITCHGEAR DIVISION BIRMINGHAM 6

# London Telecommunication Tower

OWING to the risk of obstruction to television and radio telephone services from the high buildings already built and planned in London, the G.P.O. is to build a 500ft tower at the Museum exchange in Howland Street, London. This will replace the radio mast on the existing building which gives an effective height of only 180ft. The Museum exchange is also the switching centre for the intercommunication of outlets from London to the existing national radio and television network in the London area and the B.B.C. and I.T.A. transmitters and from numerous television studios in the London area. It is also the London focal point for micro-wave radio links over which more and more trunk telephone traffic is being carried instead of by underground cables.

The Post Office will provide a public observation platform on the tower at a height of about 460ft. This will be reached by high-speed lifts, which will take some 40 seconds on the journey.

The new tower is to be built alongside and in conjunction with a four-storey extension to Museum exchange. The whole will cost about £1,500,000 and construction work is expected to start later this year.



*Ministry of Works model of the proposed extension to the G.P.O.'s telephone exchange in Howland Street, London. The 500ft tower will be used for television and radio telephony*

## Furnaces for New Transistor Factory

An order for nine furnaces to be installed in a transistor factory being erected at Basingstoke has been received by Royce Electric Furnaces, Ltd., from Associated Transistors, Ltd. The new plant will include furnaces for alloying and diffusion. The furnaces will be controlled by proportional, stepless indicating controllers acting through magnetic amplifiers and saturable core reactors. Temperatures will be recorded on a multi-position potentiometric instrument.

## MOBILE DEMONSTRATION UNIT

The latest equipment produced by E.M.I. Electronics will be displayed during a six-month tour of their mobile demonstration unit which started on 2nd February. The 25ft trailer incorporates a closed-circuit television system which enables visitors seated in the reception area to see demonstrations being given inside the unit. The equipment on view includes an Emiac II general purpose analogue computer, an instrumentation tape deck which processes and stores information in analogue and digital forms, two nuclear health monitors, a range of valves, an automatic commutator undercutting machine and a dynamic balancing machine.

H

# *Turbine Blade Failure Research*

ELECTRONIC equipment to be used for research into the causes of turbine blade failure in steam turbine generating plant is to be supplied to the Central Electricity Generating Board by Bristol Aircraft, Ltd., a company of the British Aircraft Corporation. The contract provides for the purchase by the C.E.G.B. of a vibration test equipment package and the hire of certain telemetry and other data processing equipment. It is hoped that a second order will follow in due course.

One of the biggest obstacles to effective investigation of blade failure is that it is practically impossible to simulate full-load operating conditions before the generating plant enters service. The electronic equipment made by Bristol Aircraft will allow C.E.G.B. engineers to obtain data while the generator is running under load. A capsule will be installed inside the hollow shaft of the steam turbine, and the output from transducers mounted on the turbine blades will be fed into the capsule and transmitted, via slip rings, in f.m. form to static equipment.

Basically, the electronic package to be supplied to the C.E.G.B. is a refined and developed version of equipment originally designed for "Bloodhound" guided weapon test programmes. To permit installation inside the turbine shaft, a higher degree of "transistorisation" has been introduced.

## B.E.A.M.A. LUNCHEON

Mr. Reginald Maudling, President of the Board of Trade, will be the principal guest at the annual luncheon of the Council of the British Electrical and Allied Manufacturers' Association at the Connaught Rooms, London, on 16th March.

## New Plastics Magazine

THE first issue of a new Associated Iliffe Press publication, *International Plastics Engineering*, is now on sale. This is an associate journal of *British Plastics* and is to be published monthly, price 3s 6d. It will be devoted entirely to the engineering aspects of the plastics industry and will be of interest not only to manufacturers and users of plastics machinery, but also to technologists, buyers and all others who must keep up to date on new plastics equipment and machinery. The first issue, for February, contains an article on blow moulding techniques and equipment, and descriptions of a new range of screw plasticising/injection moulding machines, of equipment for the assessment of thermoplastics pipes, of an in-line injection mould for large components, Hungarian heat welding and vacuum forming equipment, and the use of aluminium wool in polyester and epoxide resins. Regular features include new processes and ancillary equipment, and news of the industry and its personnel. Copies are available from all booksellers or the publishers at Dorset House, Stamford Street, London, S.E.1.

# NEW FILMS

THREE new colour sound films were shown in London last week. Two of them were produced by Ace Film Productions for the United Kingdom Atomic Energy Authority, while the third film was made by Cinechrome, Ltd., for International Computers & Tabulators, Ltd.

The first of the nuclear energy films, entitled "Dounreay Symposium," has a running time of 27 minutes. The film opens with an animated sequence explaining the construction of the reactor and its associated heat exchangers. This is followed by shots of foundation laying and the erection of the lower half of the containment sphere, 135ft in diameter, interspersed with shots of the manufacture of components in makers' works. Construction of the reactor vault and the erection of the upper half of the sphere occupy the next section, and finally the "fitting out" is shown. This covers the installation of the reactor vessel, heat exchangers and associated equipment, again incorporating shots of manufacture. The film sets out to show the engineering problems which arose on the fast reactor, and the way in which they were solved. It is produced primarily for engineers but no detailed knowledge of atomic energy is assumed.

The other atomic energy film which runs for 18 minutes is entitled "Steel for Nuclear Power." It is mainly concerned with steel for reactor pressure vessels, and starts with a review of the methods of erection and testing at Calder Hall. The developments in technique for the civil power station reactors are shown, and the importance of improving testing methods to match increased plate thickness is brought out. A sequence filmed in the Culcheth laboratories shows the extent of the research and development work needed to maintain progress, and includes the examination of steel specimens which have been irradiated. The continuing examination of vessels during the working lifetime of the reactor is also shown and the film ends with a look at future requirements for projects such as the A.G.R. and the fast reactors.

Both the nuclear energy films are available in 35 or 16 mm on free loan from the U.K.A.E.A., Riseley, Warrington, Lancs., or 11, Charles II Street, London, S.W.1.

The new 30-minute 16 mm I.C.T. film is available on free loan from their Publicity Department at 149, Park Lane, London, W.1. The film is entitled "Satisfied Users" and, through the eyes of an interviewer, the audience is taken on a tour of factories, farms, offices, and Government premises as well as a famous seaside resort, to see how the I.C.T. 1200 series computers increase efficiency and productivity for their users.

## Britain and the Common Market

The Federal Trust for Education and Research have issued a report on the papers and discussions at their two-day course held in London last October entitled "The Progress of the Common Market and its Effects on the United Kingdom," price 10s 6d. Among the speakers was Mr. C. G. E. Parrott, head of the Overseas Division of B.E.A.M.A.

A further course will be held on 18th-19th May on "The Future of the Seven," details of which may be obtained from the Trust at 10, Wyndham Place, London, W.1.

## BRINGING WORK TO ANGLESEY

The Midlands Electric Manufacturing Co., Ltd., are the tenants of the first of the factories erected under the Government's drive to ease unemployment in badly affected areas. The factory, on a headland overlooking Holyhead Bay, was opened last week by Mr. Niall Macpherson, Parliamentary Secretary to the Board of Trade.

The cost of building the 26,000 sq ft factory was between £80,000 and £90,000 and it will be let at a rent of about £2,700 a year. The tenants will have an option to purchase within the first five years.

M.E.M. expect to be employing 100 local people within a year and an eventual labour force of 300 is envisaged. Pay rates will be identical with those at the company's Birmingham factories.

## E.C.A. Liverpool Dinner

We regret that in the "Next Week's Events" section of last week's issue we gave the date of the annual dinner of the Liverpool Branch of the Electrical Contractors' Association as 10th February. Actually it is on 14th March.

# *Control Board for Russia*

THE Motor and Control Gear Division of Associated Electrical Industries, Ltd., recently shipped to Russia the longest control board ever made at its Rugby works. The board is over 61ft long and includes a 13ft laminated plastic mimic control diagram fully coloured to indicate the various flow paths.

The board is one of fifteen being supplied by A.E.I. to Simon Handling Engineers, Ltd., a member of the Rustyfa consortium, for a Russian tyre factory. It will control motors driving plant for the manufacture of rubber pellets from incoming rubber slabs and their transfer to the main storage bins. It will also control the equipment used for transferring these pellets from the main storage bins to the process bins at each of the mixing stations.

*One of fifteen control boards being supplied by A.E.I. for a tyre factory in the U.S.S.R.*

### Trawler's A.C. Auxiliaries

The fishing vessel M.T. *Trueman*, owned by the Crampin Steam Fishing Co., Ltd., and launched recently at the Beverley Yard of Cook, Welton & Gemmell, is unusual in having a.c. motors for all the auxiliaries with the exception of the trawl winch equipment. Two 56 kW alternators, to be driven by Ruston Hornsby engines, a 17 h.p. windlass motor and two 3 h.p. steering gear motors are being supplied by Laurence, Scott & Electromotors, Ltd., in addition to various other motors for engine room auxiliaries including a 10 h.p. motor for the fresh water circulating pump and another 10 h.p. motor for the standby and salt water circulating pump. The company is also supplying all control gear with the exception of that for the windlass. The trawl winch electrical equipment, supplied through the winch makers, C. D. Holmes, includes a 170 kW Ward-Leonard generator driven from a Ruston 6VCBXZ engine, a 208 h.p. motor and control gear.

### BUSY MONTH FOR G.E.C. MARINE DEPARTMENT

On 11th January the first of two new diesel-electric chain ferries with G.E.C. propulsion equipment was officially handed over to Cornwall County Council. Between then and the end of the month five more ships with G.E.C. equipment were launched or commenced their trials, representing (for all six contracts) approximately £500,000 worth of business to the company. In addition, the department has in hand contracts for work on nearly 40 vessels, including the liners *Canberra* (P. & O.-Orient), *Empress of Canada* (Canadian Pacific) and *Principe Perfeito* (Cia. Nacional de Navegacao, Portugal).

### Permanent Floor Warming Showroom

The successful application of floor and ceiling heating by embedded electric cables depends on close co-operation between architect, engineer and contractor, and the interchange of ideas and experience. To assist in this, Volex Electrical Products, Ltd., have prepared a demonstration room in their works at Frederick Road, Salford, to cover building materials, thermal insulation, and cable design, manufacture, installation and control. Sectioned models are included and illustrated lectures and discussions will be arranged to suit particular interests. Readers are invited to visit the showroom, preferably by appointment (telephone: Pendleton 2442).

*The lighting showroom at Courtney, Pope's new Birmingham branch*

## Courtney, Pope Birmingham Branch

The Birmingham branch of Courtney, Pope (Electrical), Ltd., has recently been moved to larger premises owing to the expansion of the company's business in the Midlands. The new address is Nechells House, Dartmouth Street, Birmingham, 7 (telephone: Aston Cross 4541/2). Nechells House, a new building, is within easy reach of the city centre and ample car parking facilities are available on the premises. The Birmingham branch now offers trade counter facilities and a wide range of lighting fittings are available. The showroom, which was designed in conjunction with Mr. Victor Cornet, design consultant, has a wide range of tungsten and fluorescent fittings and a full-size shop window is incorporated. The branch is in charge of the area manager, Mr. John Hall.

## TRADE ANNOUNCEMENTS

The four marketing groups, G.L.S., Photographic, Discharge and Vehicle Bulbs, and the Advertising Department of the Osram Lamp Division of the **General Electric Co., Ltd.**, have moved from Magnet House, Kingsway, W.C.2, to the Osram Lamp Works at East Lane, Wembley, Middx. (telephone: Arnold 4321).

**Goodmans Industries, Ltd.**, announce that they have now established three main agencies in the United Kingdom to handle their vibration test equipment on a sales and service basis, as follows:—Midland area, Hawnt & Co., Ltd.; Northern England, Farnell Instruments, Wetherby; and Scotland, A. R. Bolton & Co. All future inquiries from these areas should be made to the agencies concerned.

A new company, **Expert Industrial Controls, Ltd.**, has been formed to bring together under one name two members of the Expert Tool Group—Sharp Control Gear, Ltd., and the Electran Coil Co., Ltd. The factory and offices of Sharp and Electran occupy a 25-acre site at Ashby-de-la-Zouch and for the past three years the two companies have had the same management. The chairman of the new company is Mr. Angus Murray, B.Sc., A.M.I.Mech.E., and Mr. Brian S. Worrall, A.M.I.E.E., is managing director.

**Alma Components, Limited**, have appointed Associated Electronic Components, Ltd., 1560, Avenue Road, Toronto, 12, Ontario, as their agents for precision wirewound resistors in Canada.

From 31st March all sales and manufacturing activities of **Astral Switchgear, Ltd.**, are being transferred to a new factory at Ulverston, near that of the associated company, Ashley Accessories, Ltd. From that date all communications should be addressed to the company at Morecambe Road, Ulverston, Lancs (telephone: Ulverston 3333).

### CHANGE OF NAME

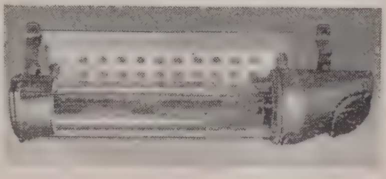
H. & E. Lintott, Ltd., of Horsham, have changed their name to Lintott Engineering, Ltd. The company is a member of the Ayling Industries Group.

# NEW ELECTRICAL EQUIPMENT

## MULTI-SOCKET INDICATOR STRIP

A multi-socket indicator strip for use with such equipment as computers and illuminated readout devices has been introduced by the Special Products Division of **Thorn Electrical Industries, Ltd.**, Thorn House, Upper St. Martin's Lane, London, W.C.2. This unit, produced in strips of 12 sockets with both ½ and ¾in centres and having an overall length of 6in and 9in respectively, requires only one earth connection irrespective of the unit length employed. A single socket similar to the indicator strip is also available, which can be used separately or in conjunction with the multi-strip socket. Lamps are available for 6, 12 or 28 V, 35-45 mA, with a life of 3,000-5,000 hours. Translucent plastic caps are obtainable in white, red, yellow or green, to fit directly over the lamp, thus eliminating the need for prismatic jewels.

*Three Electrothermal drum heaters*



*Heyes flameproof sodium lighting fitting*

*Thorn multi-socket indicator strip*

## CAM PICK-OFFS

Devices described as "electronic micro switches" which can be operated by moving machinery without being in electrical contact with it have been announced by **Servo Consultants, Ltd.**, 10, Bouverie Place, London, W.2. They are intended to replace a pair of electrical contacts operated mechanically by a cam, rack or similar device on a machine.

The normal gap between the front end of the unit and the cam, which must be of a magnetic material, can vary between 0 and 0·03in for the "on" condition and should be more than 0·25in for the "off" condition. Its response range is from d.c. to approximately 1,000 r.p.m. and the accuracy of resolution is ±0·02in, giving an angular accuracy of approximately 25 minutes of arc when using a 6in diameter cam. A Plessey Mk4 three-way plug is provided for the connections to the 7-10 V d.c. power supply and the load, which may be a relay, solenoid or counter.

In the type 400 unit, intended to operate electronic equipment, the output changes between limits during a 0·03in transition of the cam edge. The output impedance is 40 kΩ. Electromechanical units and warning lamps can be operated by the type 401 unit, the maximum load of which with a 10 V supply is 75 Ω. The type 402 unit is intended for applications where its fast rise time of approximately 35 μsec is required. The minimum load impedance must be 40 kΩ. The current consumption for the types 400 and 402 is 25 mA and for the type 401 is 200 mA approximately.

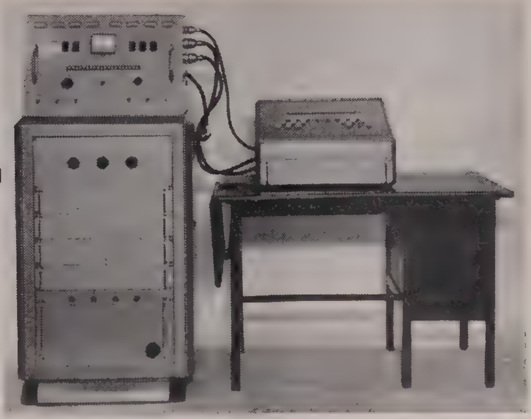
## FLAMEPROOF LIGHTING FITTING

A sodium lighting fitting for use in flameproof areas has been developed by **Heyes & Co., Ltd.**, Water-Heyes Electrical Works, P.O. Box 60, Wigan. This fitting (Catalogue No. 1130) is flameproof and weatherproof and is designed to take a Type SO 140 W sodium lamp, giving an average output of 9,800 lumens for a lamp life of 4,000 hours. Supplied in cast aluminium but available in cast iron if required, the fitting has one cable entry for either gland or conduit up to 1in e.t. Other details include length 26⅞in; height $8\frac{7}{16}$in; width 6in; fixing centres 22⅜in by 6in, four holes ⅜in in diameter; and weight 24 lb. A ballast unit (Catalogue No. 1135/S) has also been developed designed to house the control gear for this fitting or the 483 wellglass lighting fitting when fitted with a 250 W MBF/U lamp. The terminal chamber of this ballast unit can be arranged for up to four cable glands or conduit entries. Both types are supplied complete with tapped transformer or choke condenser and h.r.c. fuse.

## DRUM HEATER

A heater for drums containing viscous or solidified materials has been introduced by **Electrothermal Engineering, Ltd.**, 270, Neville Road, London, E.7. It consists of a stainless steel outer cover containing the heating element which is insulated by high temperature resisting materials.

The terminal box, suitable for ¾in o.d. flexible conduit entry or supplied with a ¾in insulated or metal bush for a high temperature cable, is situated near the handles, which are joined by a steel spring ensuring intimate contact of the heater with the drum. The heaters are suitable for use with drums of 40-50 gal capacity and diameters



*Elliott programmed automatic circuit-checking equipment*

between 22½ and 23½in. The heater is 5½in wide and weighs approximately 9 lb. The maximum temperature of a free-standing heater is 350°C.

The heaters are suitable for operation from a 200-250 V supply and have an electrical loading of 2 kW. The price is £2 each. Controllers for one or three heaters are available, priced at £3 5s and £9 2s 6d each, respectively, and high temperature cable is available at 8s 6d per yard.

## CIRCUIT-CHECKING EQUIPMENT

The programmed automatic circuit-checking equipment designed by the Automatic Test Equipment Division of Elliott Brothers (London), Ltd., a member of the Elliott-Automation Group, 34, Portland Place, London, W.1, has been developed to facilitate the routine checking of complex cable forms or similar constructions. The model illustrated is capable of carrying out four tests with up to 600 terminations, each termination being checked against every other.

The tests comprise checks on resistance between pairs of terminations from 0 to 100 Ω with permissible tolerances of 5, 10 or 20 per cent; continuity between pairs by ensuring that the resistance is not greater than 0·5 Ω; and ensuring that insulation between lines and insulation to earth is greater than 20 MΩ.

Any of the above tests can be selected for any particular pair of terminations by a predetermined programme. The instructions are "written" on a 1in magnetic tape in accordance with a cable or termination schedule which applies to the equipment under test. This equipment is connected to the circuit checker in a standard numerical sequence which coincides with the termination schedule and programme numbering.

The number of possible combinations with 600 terminations is 180,300. Only 120in of tape is needed to accommodate all possible programme material. An automatic fault recorder in the form of a coded print-out is under development.

## OIL DIELECTRIC TEST SET

The portable test set type WTR/297/ODTS/N designed by the Willesden Transformer Co., Ltd., Manor Works, Manor Park Road, Harlesden, London, N.W.10, incorporates a standard test cell which permits tests for the electric strength of transformer oils to be carried out under B.S. 148 : 1951. Further cells can be provided permitting tests to be carried out on bitumen-based filling compounds in accordance with the B.S. 1858 : 1952.

The tester can be operated from 110-120, 200-220 and 230-250 V 50/60 c/s single-phase supplies—a plug-in voltage selector plate being provided. The h.v. supply is obtained from a transformer having a maximum output of 55 kV r.m.s. with no inherent waveform distortion. A "Variac" transformer in the primary circuit provides infinite control over the output range. A double-pole circuit-breaker fitted with overload coils trips immediately failure of the oil sample occurs, but the breakdown voltage remains indicated on a voltmeter until the a.c. supply is disconnected. The set carries full inter-Services approval with reference No. CT/435.

## ISOLATING SWITCH IMPROVEMENT

An improved type of contact on rural rocking type isolating switches is now offered by Line Equipment, Ltd., 71a, Queen Victoria Street, London, E.C.4. Previously the switch embodied the conventional tubular type of blade. The replacement of this by a "hair-pin" blade formed of ⅜in diameter copper rod provides improved mating of fixed and moving contacts through the tendency of the latter to spring outwards at the point of contact. In addition, the blade itself provides two parallel paths for currents and the arrangement of these facilities improves cooling. This has resulted in an increase in the fault current rating, a 3 sec withstand of 15 kA now being offered compared with the previous rating of 13·1 kA.

## IMPROVED SILICON CONTROLLED RECTIFIER CHARACTERISTICS

Improvements in the trigger characteristics of silicon controlled rectifiers are announced by the Electronic Apparatus Division of Associated Electrical Industries, Ltd. The maximum trigger current required to fire any rectifier has now been reduced to 100 mA and the maximum voltage required to 3·75 V. The improvement will benefit users who wish to employ pulse triggering of controlled rectifiers. Additional information is available from the Valve and Semiconductor Sales Department, A.E.I. Electronic Apparatus Division, Carholme Road, Lincoln.

## ELECTRONIC WEIGHING CONTROLLER

Electronic weighing control equipment for mixing and blending purposes has recently been marketed by Electoweighebs (Birmingham), Ltd., Moseley Street, Birmingham, 12. When two materials are to be mixed the first is weighed by an electronic continuous belt weigher and signals from the weigher control unit are fed to an electronic sampler and memory unit. The delayed signals from the memory unit are then used to control the excitation of a vibratory feeder which supplies the required amount of the second material.

The belt weighing equipment comprises an electronic control unit and a weighbridge incorporating a linear inductive load cell. Voltage signals dependent on load are fed to the memory and sampler unit which registers average load and retains the signal for the requisite time period (up to 45 sec) before operating a servo motor driven toroidal transformer, the voltage output of which supplies variable excitation to the vibrator feeder which in turn varies the flow of the second material.

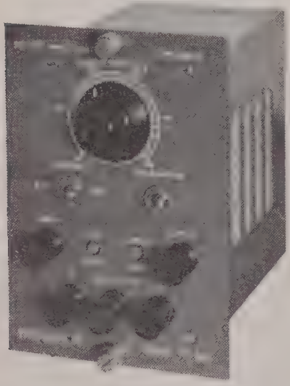
## SUB-MINIATURE POTENTIOMETERS

The range of potentiometers announced by Egen Electric, Ltd., Charfleet Industrial Estate, Canvey Island, Essex, has been designed for use in transistor circuits. Constructed on a die-cast body of only ½in diameter, these bush mounted controls have a moulded spindle of $\frac{3}{16}$in maximum diameter and will be available with standard resistance values in the range 1,000 Ω to 3 MΩ with a logarithmic or linear law. Lower values can be made to special requirements. Two models will be manufactured initially, the type 363—non-switch—and the type 365 with a 50 V 150 mA double pole single throw switch, both with standard soldering tags. Other models for printed panel mounting are planned for production in the near future.

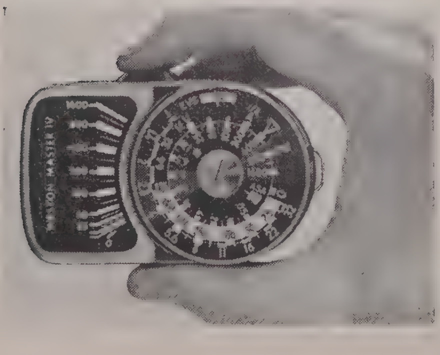
## SQUARE-WAVE UNIT

The square-wave unit type SW98 manufactured by Feedback, Ltd., an associate company of **SERVOMEX CONTROLS, LTD.**, Crowborough, Sussex, provides a square-wave driving signal for repetitive analogues at mains frequency. The unit also generates square waves from externally applied sine waves over the frequency range 50 c/s to 10 kc/s. The rise time is about 2 μsec for any operating frequency and a mark-space ratio trim is provided to enable an exact 1 : 1 ratio to be obtained. The minimum external signal for satisfactory operation is 2 V peak, and the output is continuously adjustable from 0 to 50 V peak-to-peak independent of the input amplitude.

A tuned circuit has been incorporated to generate a calibration oscillation for time measurement on an oscilloscope trace for use with repetitive analogues. The calibration frequency is 2·5 kc/s, and the oscillation train may be switched to occur during either the positive or negative half of the square wave. The price is £25.



*Feedback, Ltd., square-wave unit*



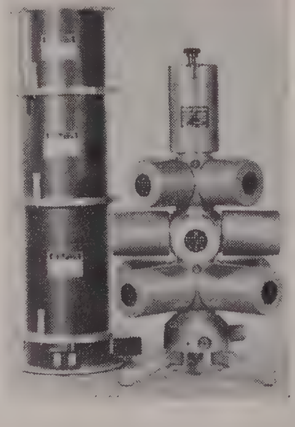
*" Weston Master IV " exposure meter*

## PHOTOGRAPHIC EXPOSURE METER

A new photo-electric exposure meter for photographers has been introduced by **SANGAMO WESTON, LTD.**, Great Cambridge Road, Enfield, Middlesex. This latest model, which is known as the " Weston Master IV," differs from its predecessors in that it is housed in a compact stainless steel case, has greater sensitivity and is fitted with a pointer lock which enables readings to be held. The comprehensive information given by the calculator dial is larger and clearer than on previous models so the instrument is easier to use. The meter is calibrated to A.S.A. specifications and is marked for exposure indexes up to 16,000 A.S.A. There are two overlapping ranges which enable readings of 0·1 to 1,600 to be taken. The instrument costs £9 18s 6d, including purchase tax.

## CAPACITANCE STANDARDS

A range of switchless capacitance standards has been introduced into the United Kingdom by **AVELEY ELECTRIC, LTD.**, Ayron Road, Aveley Industrial Estate, South Ockendon, Essex. The Jahre system uses five- and six-sided connector blocks and plug-in units to give combinations from 10 pF to 10 mF in 10 pF increments. Unused ports on the connector blocks are covered by screening caps while the capacitor units are stored in polished wood racks. Variable capacitors provide continuous coverage of 16 or 70 pF, with discrimination of 0·01 pF and 0·1 pF respectively. Air dielectric is used in the sizes up to 400 pF which have loss factors below 1 in $10^5$. The coaxial system of connection of the units ensures complete screening and high natural resonant frequency, series inductance being less than 0·06 μH per unit. Each capacitor is adjusted to ±0·1 per cent ±0·1 mmF and calibration certificates are issued for each unit and for the connected assemblies. The stability is guaranteed better than 0·05 per cent per year. In practice, drifts of the order of 0·01 per cent per annum may be expected. Temperature coefficients are +20 parts per million/°C for the units up to 400 pF and 30 p.p.m. for the larger units.



*Switchless capacitance standard available from Aveley Electric, Ltd.*

## TRANSISTOR CIRCUIT POWER SUPPLY UNITS

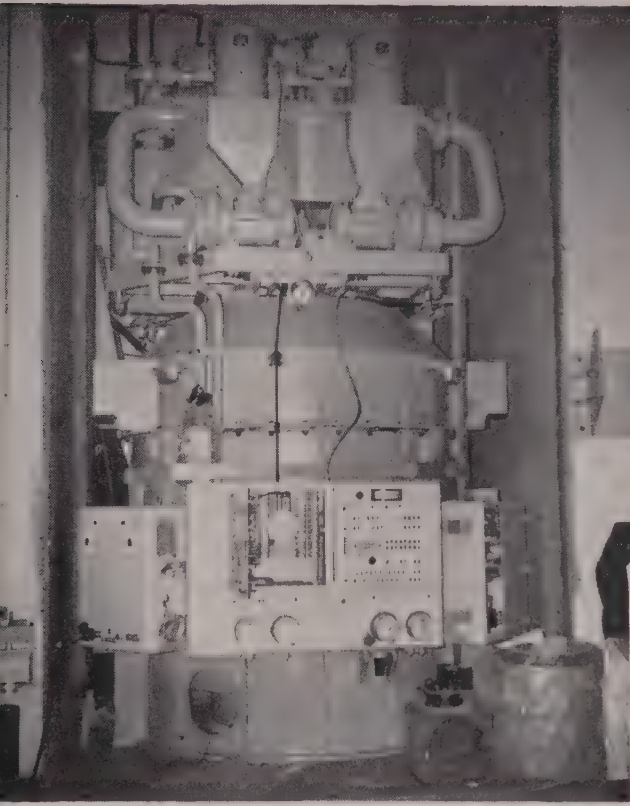
A method of obtaining power supplies for transistor circuits is provided by a range of standard electronic sub-assemblies announced by **MULLARD EQUIPMENT, LTD.**, Mullard House, Torrington Place, London, W.C.1. The range consists of four basic units, combinations of which can provide stabilised and unstabilised power supplies to meet the requirements of most types of transistorised electronic equipment and control systems. The range comprises two unstabilised units with outputs of up to 1 A and 5 A respectively at 0 to 39 V, adjustable in 3 V steps; a 250 mA stabiliser with a stability factor of 200 : 1 for mains variations between +10 per cent and −15 per cent of the nominal; and a series regulator unit. The unstabilised units may be used alone when the circuits to be supplied are insensitive to power supply variations, or where cost is the paramount consideration. For applications requiring stabilised currents, the stabiliser and/or series regulator units are added as appropriate.

Assembly of the units into the required combination is accomplished speedily by simple bolt fixings. The maximum voltage from combinations incorporating the stabiliser or series regulator units is 30 V. Coarse control of the output voltage is governed by adjustable taps on the mains transformer of the unstabilised units, fine control by a pre-set potentiometer in the stabiliser. In addition to its main output each of the unstabilised units has two subsidiary outputs. Those of the 1 A unit provide 200 mA at 6, 12 and 24 V and 20 mA at 36 V; those of the 5 A unit provide 1 A at 6, 12 and 24 V and 100 mA at 36 V.

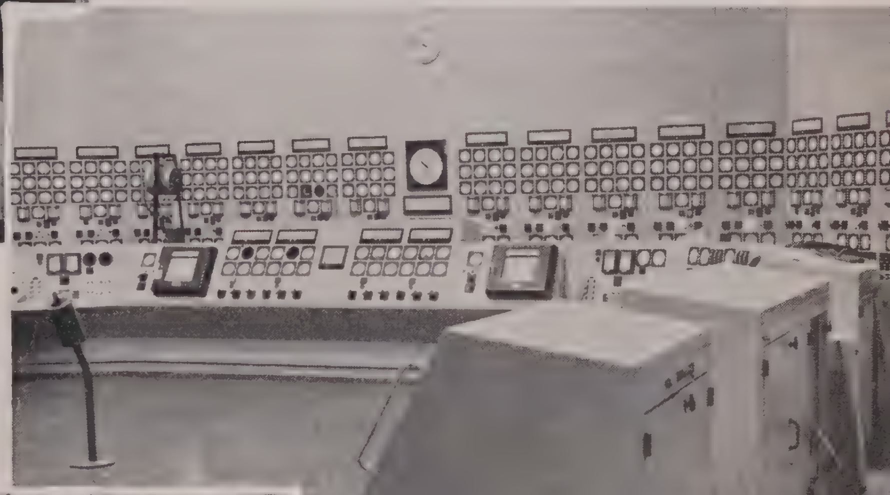
# BERKELEY

## First Reactor Nears Completion

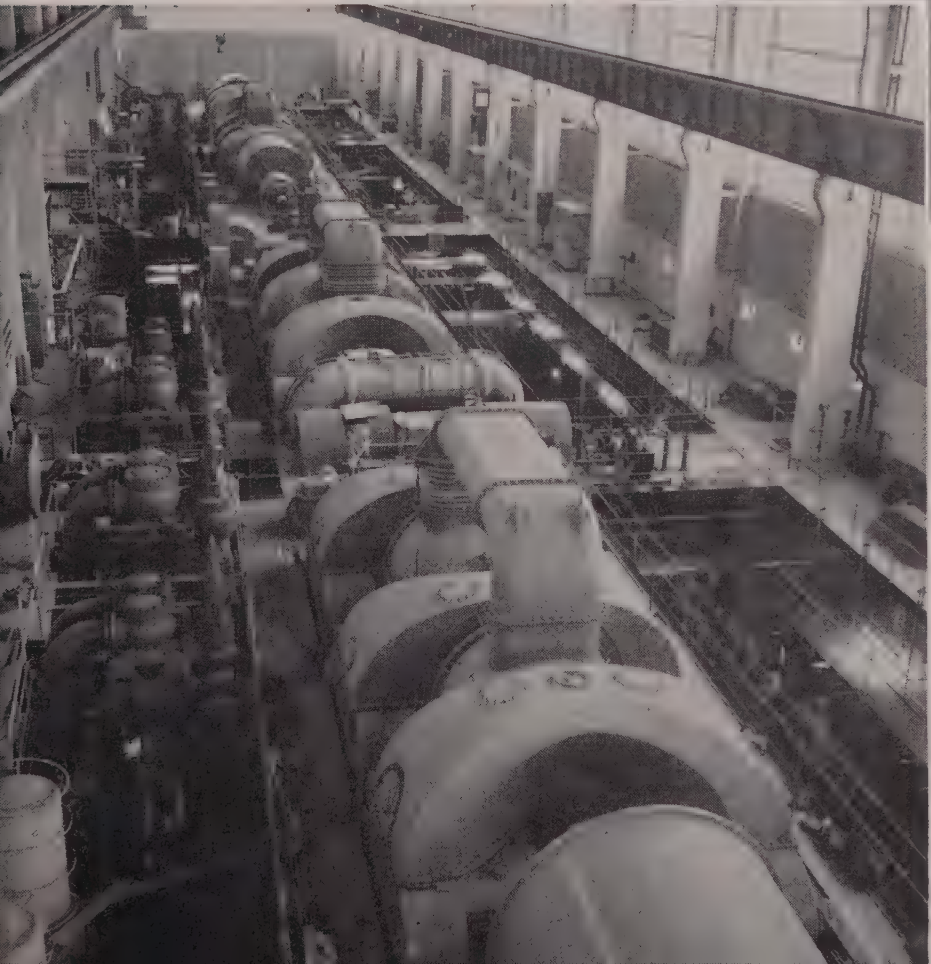
THESE illustrations, taken last month, show the progress which has been made with the nuclear generating station being built for the Central Electricity Generating Board at Berkeley, Gloucestershire, by the Nuclear Power Group. The loading of the natural uranium fuel into No. 1 reactor should begin next month and it is expected that criticality will be achieved towards the end of April. The reactor should be operating with its two associated 83 MW sets on full load by the autumn. The construction of No. 2 reactor is phased some six months later.



*One of the charge/discharge machines immediately prior to test on the pile cap of No. I reactor*



*A section of the main control room at the station showing all the boiler controls in the background and the control dais, which will be monitored by two C.E.G.B. operators*



*Construction of the four 83 MW turbo-generators installed longitudinally in the turbine hall at Berkeley has almost been completed*

## *Financial Section*

# STOCKS and SHARES

WHILE the big institutional investors such as the insurance companies and pension funds are said to be maintaining a distinctly cautious attitude towards commitments in the industrial markets of the Stock Exchange at the present high level of prices, the latter have continued to move steadily upwards in response to an insistent demand for good shares from the general public. This was encouraged by the reports of a perceptible improvement in motor-car sales last month, and a little excited no doubt by the extraordinarily numerous "take-over" or merger propositions which have appeared in recent weeks, some of them having spectacular reactions upon the individual shares concerned. Confidence has been considerably assisted by Wall Street's good reception of the new President's outline of his policy intentions.

### Electrical Shares

Since the termination of the talks between English Electric and G.E.C., none of the more dramatic of recent merger proposals has been staged in the electrical sections of the industrial market, but these events have had the effect of reviving interest in some of the issues which have from time to time in the past been regarded as likely candidates for attention. A leap of 5s 6d, to 36s 9d, in the shares of Electric Construction seemed for instance to be associated with such considerations; and there were advances in A. C. Cossor, British Thermostat and Johnson & Phillips, none of them strangers to "bid" rumours in the past. Elsewhere, the reports of better employment in the motor-car industry were reflected in higher prices for shares such as Pressed Steel, S. Smith, Oldham & Son, and Chloride Electrical Storage, although Joseph Lucas were unresponsive.

### Better Prices

Shares of the major electrical groups were not much altered, but Reyrolle and C. A. Parsons moved up, while Metal Industries went strongly ahead to 60s and Thornycroft rose a further 3s 9d, to 33s 9d, on news of the sale of a subsidiary to A.C.V. In the domestic equipment group the irrepressible Dimplex put on yet a further 4s 9d, reaching 61s 3d and bringing their net advance since the beginning of the year to 14s. Signs of a rather better feeling in this section were seen in Hoover at 48s 3d and Radiation at 34s 6d. E.M.I., Ever Ready and Thorn Electrical also hardened. In other departments, improvements of note were recorded in Plessey, Westinghouse Brake, Duport, Marryat & Scott, A. H. Hunt and others.

### Decca Interim

Decca shares were marked up in advance of the first interim dividend announcement and were well main-

## *Price Changes in*

| Company or Board | Nom. Value | Middle price 6th Feb. | Week's Rise or Fall | Dividend Pre-vious | Dividend Last | Yield % | 1960 High-est | 1960 Low-est |
|---|---|---|---|---|---|---|---|---|
| *Gilt-edged Stocks* | | | | | | £ s d | | |
| Brit. Elec. 1968/73 ... ... | 100 | 74 | | 3 | 3 | 4 1 0 | 79½ | 74 |
| Brit. Elec. 1974/77 ... ... | 100 | 70 | | 3 | 3 | 4 5 9 | 76 | 69 |
| Brit. Elec. 1976/79 ... ... | 100 | 72 | | 3½ | 3½ | 4 17 3 | 79½ | 72½ |
| Brit. Elec. 1974/79 ... ... | 100 | 81½ | −½ | 4¼ | 4¼ | 5 4 3 | 90½ | 81 |
| Brit. Elec. 1967/69 ... ... | 100 | 89½ | | 4½ | 4½ | 4 19 0 | 97½ | 90 |
| *Overseas Electric Supply* | | | | | | | | |
| Calcutta Elec. ... ... ... | £1 | 21/- | | 7† | 7½† | 11 14 0 | 21/- | 19/3 |
| East African Power ... ... | £1 | 14/- | | 8 | 10 | 14 5 6 | 20/3 | 13/- |
| Nigerian Elec. ... ... ... | £1 | 17/- | | 8 | 10 | 11 15 6 | 19/9 | 15/6 |
| Perak Hydro-Elec. ... ... | £1 | 18/- | | 10 | 10 | 11 2 0 | 21/- | 15/3 |
| *Electrical Shares* | | | | | | | | |
| Aberdare Holdings ... ... | 5/- | 14/6 | | 17½ | 17½ | 6 0 9 | 19/- | 14/6 |
| Aerialite ... ... ... ... | 1/- | 6/9 | | 54 | 54 | 8 0 0 | 9/6 | 6/3 |
| Allen, W. H. ... ... ... | £1 | 38/3 | +9d | 14 | 10*‡ | 5 4 6 | 43/9 | 34/6 |
| Allied Insulators ... ... ... | 5/- | 9/3 | +3d | — | 20 | 5 8 0* | 11/6 | 9/- |
| Alwyn Holdings ... ... ... | 5/- | 26/3 | | — | 12½ | 2 7 6 | 30/6 | 17/9 |
| Anglo-Portuguese Tel. ... ... | £1 | 23/9 | | 9 | 9 | 7 11 6 | 29/- | 22/6 |
| Arcolectric ... ... ... | 1/- | 4/- | | 15 | 15 | 3 15 0 | 5/6 | 3/9 |
| Aron Meters ... ... ... | £1 | 68/- | | 15 | 15 | 4 8 3 | 90/- | 47/- |
| Assoc. Elec. Ind. Ord. ... ... | £1 | 41/3 | | 15 | 15 | 7 5 6 | 66/6 | 39/6 |
| Automatic Tel. & El. ... ... | 5/- | 15/3 | −6d | 17 | 17 | 5 11 6 | 21/9 | 14/6 |
| Babcock & Wilcox ... ... | £1 | 31/3 | −6d | 13 | 9 | 5 15 3 | 48/9 | 32/6 |
| Bakelite ... ... ... ... | 10/- | 48/9 | | 15 | 17½ | 3 0 0* | 52/- | 33/6 |
| Baldwin, H. J. ... ... ... | 2/- | 1/6 | | 20 | — | — | 2/6 | 1/9 |
| Berry's Electric ... ... ... | 5/- | 38/9 | | 30 | 30*‡ | 3 17 6 | 38/6 | 22/3 |
| Bowthorpe Holdings ... ... | 2/- | 8/3 | +3d | 27 | 18½* | 4 9 6 | 11/6 | 7/9 |
| Brit. Elec. Resistance ... ... | 2/- | 6/9 | | 17½ | 17½*‡ | 5 3 9 | 8/3 | 4/6 |
| Brit. Elec. Traction: | | | | | | | | |
| Def. Ord. "A" ... ... | 5/- | 48/6 | +1/6 | 35 | 40 | 4 2 6 | 49/3 | 42/- |
| Brit. Electronic Ind. ... ... | 5/- | 12/9 | +3d | — | 15‡ | 5 17 9 | — | — |
| B.I. Callender's ... ... ... | £1 | 57/- | | 13½ | 13½ | 4 14 9 | 61/- | 47/9 |
| B.I. Callender's 6% Pref. ... | £1 | 18/- | | 6 | 6 | 6 13 3 | 21/- | 18/6 |
| British Thermostat ... ... | 5/- | 37/6 | +2/6 | 35 | 20* | 2 13 3 | 32/6 | 21/3 |
| Brook Motors ... ... ... | 10/- | 48/6 | | 25 | 25* | 5 3 0 | 53/6 | 43/9 |
| Bulgin, A. F. ... ... ... | 1/- | 9/6 | | 50 | 55 | 3 17 3 | 10/3 | 8/- |
| Bulpitts ... ... ... ... | 5/- | 17/9 | +3d | 15 | 16¼ | 4 11 6 | 23/3 | 16/6 |
| Burco Dean ... ... ... | 5/- | 9/9 | +3d | 18 | 15 | 7 13 9 | 15/9 | 8/9 |
| Cable & Wireless ... ... | 5/- | 17/9 | +2/- | 10 | 10* | 2 16 3 | 18/3 | 14/3 |
| Cambridge Instruments ... | 5/- | 32/- | | 11¾† | 12½† | 3 3 9 | 33/- | 24/9 |
| Chloride El. Storage "A" ... | £1 | 73/6 | +6d | 20 | 17½* | 4 15 3 | 81/- | 65/6 |
| Clarke Chapman ... ... | £1 | 45/- | | 13¾ | 13¾ | 6 2 3 | 63/9 | 45/- |
| Combined Elec. Mfrs. ... ... | 4/- | 7/9 | | — | 12½‡ | 6 9 0 | 8/6 | 8/- |
| Contactor Switchgear ... | 5/- | 15/- | | 14 | 14 | 4 13 3 | 17/9 | 14/6 |
| Cossor, A. C. ... ... ... | 5/- | 7/6 | +9d | 5 | Nil | — | 10/- | 5/- |
| Crabtree ... ... ... ... | 10/- | 28/6 | +1/- | 20 | 12½* | 4 7 9 | 39/6 | 24/- |
| Crompton Parkinson ... ... | 5/- | 12/- | | 14 | 12½* | 5 4 3 | 15/- | 10/9 |
| Davis & Timmins ... ... ... | 5/- | 31/9 | +6d | 20* | 30‡ | 4 14 6 | 35/- | 17/- |
| De La Rue ... ... ... | 10/- | 58/9 | +1/3 | 22½ | 22½‡ | 3 15 9 | 78/6 | 47/9 |
| Decca "A" ... ... ... | 10/- | 55/6 | +1/6 | 20 | 23½ | 4 4 3 | 51/3 | 40/9 |
| Desoutter ... ... ... ... | 5/- | 50/- | | 21⅜ | 30 | 3 0 0 | 50/- | 37/6 |
| Dewhurst ... ... ... | 2/- | 8/6 | +3d | 20 | 20 | 4 14 3 | 8/6 | 7/- |
| Dictograph Tel ... ... ... | 2/- | 10/3 | +3d | 20 | 20* | 3 18 0 | 9/9 | 7/9 |
| Dimplex ... ... ... ... | 5/- | 61/3 | +4/9 | — | 30 | 2 0 9* | 48/- | 22/6 |
| Dubilier Condenser ... ... | 1/- | 2/3 | | 25 | 30 | 6 13 3* | 3/3 | 2/3 |
| Duport ... ... ... ... | 5/- | 14/9 | +2/- | 17½ | 20 | 4 10 3* | 20/- | 12/9 |
| E.M.I. ... ... ... ... | 10/- | 44/6 | +1/- | 20 | 17½* | 3 18 9 | 58/9 | 41/9 |
| Eleco ... ... ... ... | 2/- | 4/9 | +3d | 20 | 20 | 4 4 3* | 4/6 | 2/6 |
| Electrical Apparatus ... ... | 5/- | 17/6 | +3d | 14½ | 20 | 5 14 3 | 18/3 | 12/9 |
| Electrical Components ... ... | 5/- | 9/3 | | 15 | 11½* | 6 4 3 | 13/9 | 9/6 |
| Elec. Construction ... ... | £1 | 36/9 | +5/6 | 9 | 9 | 4 18 0 | 43/- | 31/3 |
| Elliott-Automation ... ... | 5/- | 28/6 | +6d | 9·3 | 12‡ | 2 2 0 | 36/- | 19/9 |
| Enfield Rolling Mills ... ... | £1 | 47/6 | +6d | 15 | 15 | 6 6 3 | 56/- | 45/6 |

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

tained at prices of 58s for the 10s ordinary and 55s 6d for the "A" shares, after the declaration of a payment of 4d per share, the same as before. Last year a second interim dividend was declared in May and the final in October, raising the total for the year ended in March, 1960, from 20 to 23⅓ per cent. At that rate the "A" shares offer a yield of 4¼ per cent on a distribution covered twice by 1959–60 earnings. Three months ago the chairman forecast that 1960–61 would be another satisfactory year. In the group's radio and television sections, sales of transistor radio sets and radio-gramophones had improved, and although business in television had dropped considerably, the overall position was described as not so depressing as might have been expected. Good progress was reported in the group's other main branches.

## *Electrical Investments*

| Company or Board | Nom. Value | Middle price 6th Feb. | Week's Rise or Fall | Dividend | | Yield % | 1960 | |
|---|---|---|---|---|---|---|---|---|
| | | | | Previous | Last | | Highest | Lowest |
| *Electrical Shares—continued* | | | | | | £ s d | | |
| English Electric ... ... ... | £1 | 33/9 | +1/- | 14 | 10* | 5 18 6 | 53/- | 29/6 |
| English Electric 3¾% Pref. ... | £1 | 11/6 | | 3¾ | 3¾ | 6 10 6 | 13/- | 11/- |
| Ericsson Tel. ... ... ... | 5/- | 23/9 | −1/- | 13† | 13† | 4 9 0 | 28/6 | 20/6 |
| Ever Ready ... ... ... | 5/- | 34/6 | +2/3 | 27½ | 20* | 2 18 0 | 34/6 | 23/- |
| Falk Stadelmann ... ... ... | £1 | 23/9 | +9d | 10 | 7½ | 6 6 3 | 35/9 | 22/6 |
| G.E.C. ... ... ... ... | £1 | 31/6 | −3d | 10 | 10 | 6 7 0 | 47/6 | 29/6 |
| G.E.C. 6½% Pref. ... ... | £1 | 18/6 | | 6½ | 6½ | 7 0 6 | 22/3 | 19/6 |
| General Cables ... ... ... | 5/- | 4/3 | +3d | 15 | Nil | — | 10/- | 4/9 |
| Goblin (B.V.C.) ... ... ... | 5/- | 6/- | | 12½ | 10 | 8 6 9 | 13/9 | 6/- |
| Hackbridge Holdings ... ... | 5/- | 5/6 | +6d | 20 | 20 | 9 1 9* | 8/9 | 5/9 |
| Harland Engineering ... ... | 5/- | 16/3 | +3d | 14 | 16* | 4 18 6 | 16/3 | 13/- |
| Head Wrightson ... ... | 5/- | 22/6 | −6d | 20 | 14* | 3 2 3 | 31/6 | 20/6 |
| Heatrae ... ... ... ... | 2/- | 13/9 | | 20 | 22½ | 3 5 6 | 13/- | 8/9 |
| Holophane ... ... ... | 5/- | 18/3 | | 26 | 30 | 8 4 6 | 20/6 | 16/- |
| Hoover ... ... ... ... | 5/- | 48/3 | +1/3 | 60 | 90 | 4 13 3* | 55/- | 39/6 |
| Hunt, A. H. ... ... ... | 4/- | 21/3 | +1/9 | 15 | 20 | 3 15 3 | 24/6 | 16/9 |
| Intl. Combustion ... ... ... | 5/- | 28/9 | −1/3 | 30 | 30 | 5 4 3 | 46/9 | 23/3 |
| Intl. Computers & T. ... ... | £1 | 73/9x.r. | +5/9 | 10 | 11¼ | 3 1 0 | 78/6 | 58/9 |
| Johnson & Phillips ... ... | £1 | 20/6 | +1/9 | 5 | Nil | — | 24/- | 16/9 |
| Kenwood Mfg. ... ... ... | 1/- | 6/- | — | — | — | — | 12/- | 3/9 |
| Laurence Scott ... ... ... | 5/- | 16/9 | | 15 | 15* | 4 9 6 | 25/3 | 15/9 |
| Lister, R. A. ... ... ... | £1 | 52/- | +1/3 | 14 | 14 | 5 7 9 | 62/- | 52/- |
| Lucas, J. ... ... ... ... | £1 | 63/9 | | 12½ | 13¾ | 4 6 3 | 74/6 | 58/9 |
| Marryat & Scott ... ... ... | 2/- | 15/- | +1/3 | 22½ | 27½ | 3 13 3 | 16/9 | 13/6 |
| Mather & Platt ... ... ... | £1 | 46/6 | +1/6 | 10⅜ | 11 | 4 14 6 | 59/- | 42/6 |
| Metal Industries ... ... | £1 | 60/- | +3/- | 14 | 15 | 5 0 0 | 76/3 | 52/6 |
| Midland Elec. Mfg. ... ... | £1 | 60/- | | 10 | 12 | 4 0 0 | 61/- | 53/6 |
| Murex ... ... ... ... | £1 | 41/9 | +6d | 15 | 20 | 5 9 0* | 45/- | 35/6 |
| Newman Ind. ... ... ... | 2/- | 5/3 | | 10 | 12½ | 4 15 3 | 5/3 | 4/- |
| Oldham & Son ... ... ... | 1/- | 2/9 | +3d | 17½ | 17½*‡ | 6 7 3 | 3/- | 1/9 |
| Parsons, C. A. ... ... ... | £1 | 50/6 | +1/3 | 8½ | 9⅜ | 3 14 3 | 59/- | 44/- |
| Philips' Lamps ... ... ... | Fl.10 | 215/- | —20/- | 13·3 | 17 | 1 11 9 | £12⅜ | 137/- |
| Plessey ... ... ... ... | 10/- | 52/- | +1/9 | 15½‡ | 17‡ | 3 5 6 | 60/- | 43/9 |
| Pullin, R. B. ... ... ... | 2/- | 11/6 | | 25 | 25 | 4 7 0 | 14/3 | 10/- |
| Pyrotenax ... ... ... ... | 5/- | 51/6 | +3d | 34 | 40 | 3 17 9 | 56/- | 44/3 |
| Radiation ... ... ... ... | £1 | 34/6 | +1/- | 6 | 12 | 6 19 0 | 44/6 | 28/- |
| Reliance-Clifton ... ... ... | 5/- | 24/- | | 15 | 15 | 3 2 6 | 28/- | 22/- |
| Reyrolle ... ... ... ... | £1 | 42/- | +2/6 | 17½ | 17½ | 4 3 3* | 52/3 | 33/9 |
| Richardsons Westgarth ... ... | 10/- | 7/- | | 8½ | 8½ | — | 14/9 | 6/3 |
| Sangamo Weston ... ... | 10/- | 26/9 | | 12½ | 11* | 4 2 3 | 27/- | 19/3 |
| Scott, James ... ... ... | 5/- | 26/3 | | 24 | 25* | 4 15 3 | 34/6 | 27/6 |
| Simon Engineering ... ... | 5/- | 31/3 | +3d | — | 26·6‡ | 4 5 0 | 33/- | 28/- |
| Smith (England), S. ... ... | 4/- | 18/6 | +1/- | 17½ | 20 | 4 6 6 | 20/- | 15/6 |
| Southern Areas ... ... ... | £1 | 16/3 | +1/3 | Nil | 5 | 6 3 0 | 16/- | 13/- |
| Strand Elec. ... ... ... | 5/- | 12/9 | | 20 | 14·6* | 5 14 3 | 14/- | 10/6 |
| Sturtevant ... ... ... | 5/- | 17/- | +2/- | 15† | 15† | 7 4 0 | 24/3 | 13/- |
| Sun Elec. ... ... ... ... | 5/- | 17/6 | | 15 | 18½ | 5 5 9 | 17/6 | 15/- |
| T.C.C. ... ... ... ... | 10/- | 41/- | | 25 | 35 | 5 14 0* | 48/3 | 37/3 |
| Telephone Rentals ... ... | 5/- | 23/6 | −6d | 12½ | 15* | 3 3 9 | 24/- | 17/- |
| Thompson (John) ... ... | 5/- | 15/9 | | 25 | 20 | 6 7 0 | 25/9 | 14/6 |
| Thorn Elec. ... ... ... | 5/- | 47/6 | +1/3 | 30 | 25 | 2 12 9 | 55/6 | 44/3 |
| Thornycroft ... ... ... | £1 | 33/9 | +3/9 | 6 | 6 | 3 11 3 | 31/- | 20/3 |
| Tube Investments... ... ... | £1 | 75/9 | +1/3 | — | 14 | 3 14 0 | 95/6 | 65/3 |
| Ultra Electric ... ... ... | 5/- | 14/3 | | 20 | 25 | 8 15 6 | 29/- | 12/- |
| Walsall Conduits ... ... ... | 4/- | 12/3 | +6d | 22½ | 15* | 4 18 0 | 16/- | 10/9 |
| Ward & Goldstone ... ... | 5/- | 27/9 | +6d | 30 | 35 | 3 3 0* | 31/3 | 25/6 |
| Watford ... ... ... ... | 2/- | 9/6 | −9d | 25 | 25 | 4 4 3* | 14/- | 7/6 |
| Westinghouse ... ... ... | £1 | 38/9 | +1/3 | 11 | 11 | 5 13 6 | 59/9 | 38/9 |
| West, Allen ... ... ... | 5/- | 12/9 | | 12½ | 12½* | 4 18 0 | 17/- | 11/- |
| Wilkins & Mitchell ... ... | 5/- | 14/- | −9d | 17 | 21* | — | 25/9 | 13/6 |
| Wolf Electric ... ... ... | 5/- | 15/6 | +3d | 10 | 12½ | 4 0 9 | 14/9 | 10/9 |

### New Issues

Strong demand continued for the shares of International Computers & Tabulators. Dealings began in the new £1 shares at a premium of around 30s on the price of 45s at which they are offered by way of rights to existing shareholders. They will be transferable free of stamp duty for the next few weeks, and at the all-in price of 75s offer a yield of 3 per cent on the basis of the 11¼ per cent dividend which the company expects to maintain on the increased capital. Details of Venner's proposed "rights" issue are to be announced at the end of the month. In declaring recently a dividend of 13 per cent for 1959–60, the directors envisaged higher earnings this year and expected, with the usual reservations, that it would be possible to recommend a payment of not less than 14 per cent on capital enlarged by the issue. This would give a yield of 3½ per cent on the 5s shares at a price of 20s, without taking into account the value of the "rights."

### Muirhead & Co.

A final dividend of 7½ per cent from Muirhead & Co. brings the total for 1959–60 to the 10 per cent rate forecast at the time of the introduction of the 5s shares to the market last August. Profits improved by some 13 per cent to £367,000. After a rise in the price to 23s 9d the yield on the shares is little more than 2 per cent, but the dividend appears to be covered by earnings with a wide margin and small returns are common among investments in the fields with which the company is concerned: according to the prospectus, these included electronic and scientific instruments, facsimile transmission equipment and a considerable range of other products. Orders on hand at the beginning of this year were 35 per cent greater than their value twelve months earlier.

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### Aircraft Air-conditioning Equipment

Normalair, Ltd., has received an order worth £40,000 for the cabin air-conditioning and pressurisation equipment for three prototype Transall C160 military transport aircraft being built as a joint venture by Weser Flugzeugbau G.m.b.H. of Bremen and Nord Aviation of Paris.

# REPORTS and DIVIDENDS

**E. Shipton & Co. (Holdings), Ltd.,** are not paying a dividend for the 18 months' period to 30th September, 1960, against a total of 22½ per cent for the previous year, but, "as a mark of confidence" in the group's prospects, an interim of 10 per cent in respect of the current year is declared. Group accounts for the 18 months' period show a trading loss of £35,045 (against a profit of £36,276 for the previous year), mainly due to the writing down of stocks consequent upon re-appraisal.

Sir Leslie Nicholls, the chairman, says the directors are satisfied that the telephone rentals and sales will show an appreciable increase during the current year. Referring to the need for additional finance for expansion, Sir Leslie says discussion has progressed to the stage when the directors anticipate being able to secure finance without unduly impinging on income from existing rental contracts. It is proposed to increase the borrowing powers by £500,000.

**Electrical Component (Holdings), Ltd.,** are again paying an interim dividend of 4 per cent.

## Increases of Capital

**Atlas Electric & General Trust, Ltd.**—Increased on 23rd June, 1960, by £4,500,000 in 5s ordinary shares, beyond the registered capital of £8,700,000.

**T. Clarke & Co., Ltd.**—Increased on 10th June, 1960, by £250,000 in 2s ordinary shares, beyond the registered capital of £250,000.

## New Companies

**J. H. Oberman & Sons (Electrical Contractors), Ltd.**—Registered 27th January. Capital £10,000. To acquire the electrical contracting, maintenance and sub-contracting branch of the business and all work of an electrical nature carried on by J. H. Oberman & Sons, Ltd., etc. Directors: J. E. Oberman and T. C. Oberman. Secretary: D. I. Sharman. Regd. office: 11, New Walk, Leicester.

**J. H. Oberman & Sons (Retail), Ltd.**—Registered 27th January. Capital £10,000. To acquire the retailing of all electrical goods, etc., branch of the business carried on by J. H. Oberman & Sons, Ltd. Other particulars are similar to the above.

**Bridge Electronics & Industrial Supplies, Ltd.** — Registered 26th January. Capital £100. Directors: J. F. Hyde, A. F. Joyce and Alethea Townley (secretary). Regd. office: 32, Oakley Gardens, S.W.3.

**Randall & Daniels (Electrical), Ltd.**—Registered 26th January. Capital £3,000. Electrical engineers and general electrical installation contractors, etc. Directors: D. T. A. Randall (secretary) and E. Daniels. Regd. office: 30, Christopher Road, Skewen, Glam.

**Refrigeration Spares (Manchester), Ltd.**—Registered 26th January. Capital £4,000. Solicitors: Linklaters & Paines, 59/67, Gresham Street, E.C.2.

**General Sales & Service (Cwmgorse), Ltd.**—Registered 30th January. Capital £600. Electricians, mechanical and electrical engineers, manufacturers of and dealers in electrical, radio, television apparatus, etc. Directors: J. W. Gilbert (secretary), W. E. Watson and J. D. Jones. Regd. office: Rock Shop, 32, Gorse Street, Cwmgorse, Glam.

**John A. Frank & Co., Ltd.**—Registered 27th January. Capital £100. To acquire the business of an electrician carried on by John A. Frank at 35, Queen Street, Manchester, 2. Directors: J. A. Frank and Mrs. Marjorie S. Frank, both of 79, Grosvenor Road, Urmston, Manchester.

**Marvin Grove, Ltd.**—Registered 20th January. Capital £100. Electricians, etc. Solicitors: Coward Chance & Co., St. Swithins House, Walbrook, E.C.4.

**Britlec (Electrical), Ltd.**—Registered 23rd January. Capital £1,000. Electricians, etc. Directors: J. J. Jones and Dorothy Jones (secretary). Regd. office: 206a, Poulton Road, Wallasey.

**Quality Electrical Developments, Ltd.**—Registered 19th January. Capital £100. Directors: P. H. Main and Mrs. Alice J. Main (secretary). Regd. office: Station Close, Amersham Hill, High Wycombe.

**Electrical Tapes, Ltd.**—Registered 23rd January. Capital £100. Manufacturers of and dealers in electrical tapes of all kinds, etc. Secretary: G. C. F. Shackleford. Regd. office: 1, Chignell Place, W.13.

**W. T. Griffiths (Electrical), Ltd.**—Registered 19th January. Capital £1,000. Directors: W. T. T. Griffiths and Mrs. Doris Griffiths (secretary). Regd. office: 12, Millwood Rise, Barry, Glam.

**Floor Heating, Ltd.** — Registered 26th January. Capital £100. Electrical engineers, etc. Directors: J. M. Beskine and Nathalie Radstone. Secretary: A. J. Golding. Regd. office: 202/204, Bishopsgate, E.C.2.

**Kelwood Electrical, Ltd.**—Registered 26th January. Capital £100. Directors: R. Smith and J. Dunne (secretary). Regd. office: 67, Lord Street, Liverpool, 2.

**Watton Electronics, Ltd.**—Registered 26th January. Capital £1,000. Directors: P. A. A. Beetlestone and R. A. Camp. Secretary: S. A. Wixley. Regd. office: 202, Green Lanes, N.13.

**Ryan Electrics, Ltd.**—Registered 25th January. Capital £5,000. Manufacturers of and dealers in washing machines, etc. Directors: A. L. Ryan and Patricia E. Ryan (secretary). Regd. office: 134, Acre Lane, S.W.2.

**Coutant Electronics (Engineering), Ltd.**—Registered 25th January. Capital £100. Electronic engineers, etc. Directors: W. G. Hall, S. M. Foster, C. G. Bailey and W. E. Gilbert. Secretary: Jessie D. Hall. Regd. office: 61-62, Victoria Road, Surbiton.

**Twin-V Washing Machine (Sales) Co., Ltd.**—Registered 25th January. Capital £100. Manufacturers of and dealers in washing machines, etc. Secretary: Shirley Hart. Regd. office: Goldsmith Building, Middle Temple, E.C.4.

**Kenelec Electrical Supplies, Ltd.**—Registered 31st January. Capital £1,000. Dealers in electrical goods, etc. Directors: P. V. Kennedy and Mrs. Margaret C. Kennedy (secretary). Regd. office: 42, Oatlands Drive, Slough, Bucks.

**Phlick Engineering Developments, Ltd.**—Registered 31st January. Capital £100. Electricians, mechanical engineers, etc. R. M. Phillips, I. H. Blick and D. J. Lindsay-Scott are the first directors. Solicitors: Sumpters, 3, New Court, Lincoln's Inn, W.C.2.

**Wentonette, Ltd.**—Registered 31st January. Capital £100. Electrical engineers, etc. Secretary: L. R. Battell, 117, Hart Road, Thundersley, Essex.

**D. Leyland, Ltd.**—Registered 31st January. Capital £5,000. Manufacturers of and dealers in electrical goods of all kinds, etc. Directors: T. Leyland and Doris Leyland (secretary). Regd. office: 68/70, Loughborough Road, S.W.9.

## Receivers Appointed

**Reliant Electrical & Domestic Appliances, Ltd.**—Mr. E. J. Stone, 43, Wood Street, Northampton, was appointed receiver and manager on 15th December, 1960, under powers contained in debenture dated 6th October, 1960.

**Longford Electric Co., Ltd.**—Mr. A. V. J. More, Midland Bank Building, Spring Gardens, Manchester, was appointed receiver on 12th January, 1961, under powers contained in debenture dated 21st December, 1960.

## Liquidations

**Holmes Electrical, Ltd.,** domestic electrical appliance dealers, Bank Chambers, 8, Staniforth Road, Sheffield, 9.—Liquidator, Mr. P. Cardwell, 93, Queen Street, Sheffield, 1, appointed by members and creditors on 18th January.

**R. B. Tapes, Ltd.,** retailers of electrical apparatus, 179, Stoke Newington High Street, London, N.16.—Winding up voluntarily. Liquidator, Mr. K. R. Cork, 19, Eastcheap, London, E.C.3, appointed by members on 16th January. Particulars of claims to the liquidator by 31st March.

**A. Barlow & Co., Ltd.,** electrical contractors, 138, Church Hill, Loughton, Essex.—Last date for receiving proofs for dividend today (Friday). Liquidator, Mr. R. A. Rodgers, 25, Bedford Row, London, W.C.1.

**Colclough (Hanley), Ltd.,** domestic electrical appliance dealers, 26, Huntbach Street, Hanley, Stoke-on-Trent.—Liquidator, Mr. P. J. Snow, 17, Albion Street, Hanley, Stoke-on-Trent, appointed by members and creditors on 26th January. Particulars of claims to the liquidator by 3rd March.

**G.B.H. Distributors (Stoke-on-Trent), Ltd.,** electrical and cycle dealers, 152, Hope Street, Hanley, Stoke-on-Trent.—Liquidator, Mr. P. J. Snow, 17, Albion Street, Hanley, Stoke-on-Trent, appointed by members and creditors on 26th January. Particulars of claims to the liquidator by 3rd March.

**John Newth, Ltd.,** electrical contractors, 27, St. Aldate Street, Gloucester.—Winding up voluntarily. Liquidator, Mr. A. T. Thomas, Monument House, Southend, Ledbury, appointed by members on 24th January.

**Geoff Allen (Mansfield), Ltd.,** electrical engineers, 8, Belvedere Street, Mansfield, Notts.—Winding up voluntarily. Liquidator, Mr. H. J. Robinson, of Miller & Robinson, 30, St. John Street, Mansfield, appointed by the company and creditors on 19th January. Particulars of claims to the liquidator by 24th February.

## Bankruptcies

**P. A. Thomson,** lately carrying on business in partnership with others at 84a, Holderness Road, Hull, as Thomson Brothers & Reed, and Thomson Brothers, electrical appliance retailers and electrical contractors.—Receiving order made 23rd January on debtor's petition.

**L. A. L. Leech,** lately carrying on business as the T.L. Installation Co. (Norfolk & Suffolk), at 129a, Fore Street, Ipswich, contractor and electrical engineer.—Last date for receiving proofs for dividend today (Friday). Trustee, Mr. C. A. Taylor, 3-5, Northgate Street, Ipswich.

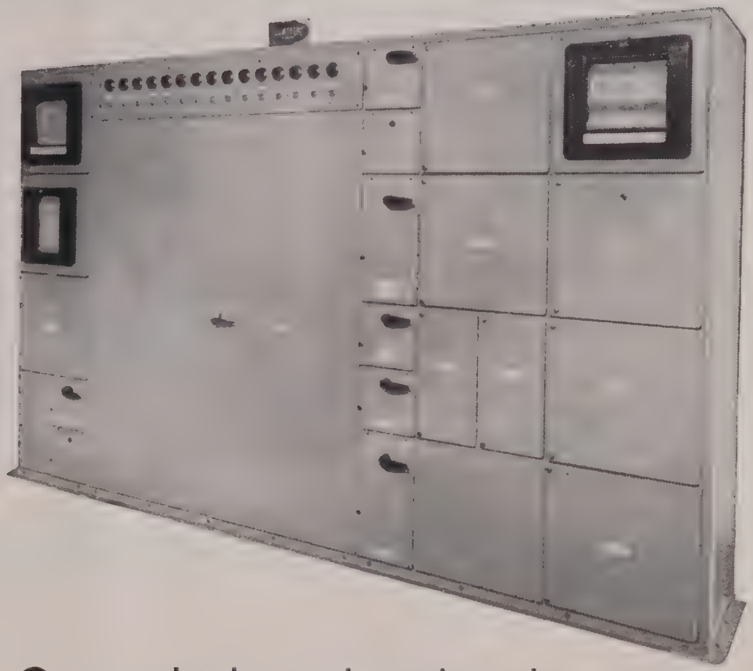
**D. Peters,** electrician, lately trading at 2, Manor Road, Carlton, Nottingham, as Denis Peters Electrical.—Public examination 6th April at the Court House, St. Peter's Gate, Nottingham.

**A. F. Guildford,** electrical contractor, 52, Mauldeth Road West, Withington, Manchester, 20.—Last day for receiving proofs for dividend 14th February. Trustee, Mr. W. H. Meredith, 20, Byrom Street, Manchester, 3.

**R. P. Dyke** and **G. J. Roberts,** lately carrying on business in co-partnership as Eastern Telectrics at 54, Waterloo Road, Norwich, electrical engineers. (Separate estate of G. J. Roberts.)—Last day for receiving proofs for dividend 14th February. Trustee, Mr. C. A. Taylor, Norfolk House, Exchange Street, Norwich.

# VARILECTRIC

# cubicle switchboards



Our cubicle and pedestal type switchboards are flexible in design, neat, compact, are front access for wiring and save money

***Our range includes—***

- DISTRIBUTION FUSEBOARDS WITHOUT AND WITH BUILT-IN ISOLATORS
- RISING MAIN BUSBARS WITH ASSOCIATED FLOOR DISTRIBUTION EQUIPMENT INCLUDING FLOOR HEATING CONTROL
- OVERHEAD BUSBARS WITH PLUG-IN FUSED TAP OFFS
- SHEET STEEL CABLE TRUNKING
- UNDERFLOOR AND SKIRTING DUCTING
- MULTI-TIER MOTOR CONTROL PANELS

Our fused switchgear
is being installed in
**S. S. CANBERRA**

**VARILECTRIC**
LIMITED

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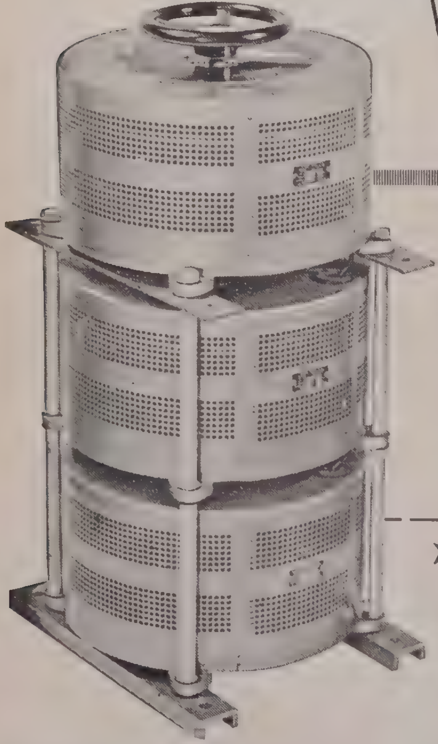

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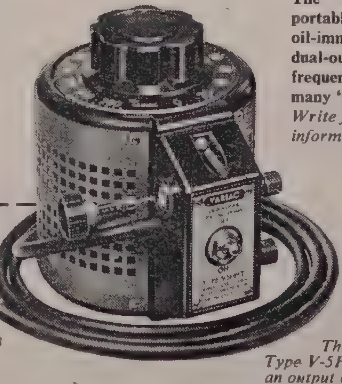

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# Swiss Market for Domestic Appliances

THREE reasons why Switzerland, despite its small size, is a good market for domestic electrical appliances are: (a) the wide availability and high consumption of electricity; its use in the house and small workshop has increased by 50 per cent in the past 10 years and is now rather more than 1,000 kWh per head of population. (b) Import duties are low and there are no quotas or restrictions on hire-purchase. (c) The standard of living is very high.

The size of the market is difficult to estimate because of the lack of detailed trade and production figures. But the Board of Trade estimate that imports of domestic electrical appliances are about 100 million Swiss Francs a year. Refrigerators account for 37 per cent, washing machines 25 per cent and other electro-mechanical appliances (of which about two-thirds are probably vacuum cleaners) 15 per cent.

Western Germany supplies over 60 per cent of Switzerland's appliance imports. The United Kingdom, in second place, supplies less than 8 per cent, followed by Sweden, Italy, France and the United States. Though there are considerable fluctuations from year to year, Britain's share of the expanding total of imports has been declining. But these figures refer to an incomplete range of appliances.

The largest business is done in refrigerators. There are twelve Swiss manufacturers who specialise in the production of small absorption type units and in 1959 their exports amounted to 7·5 million fr, about half going to this country. Imports of refrigerators amount to about 36 million fr, of which Western Germany accounts for some two-thirds. British refrigerators have become largely uncompetitive compared with low-priced German units of reasonable quality which are also more acceptable locally in internal layout. For the category 100 kg and under, the U.K. supplied 20 per cent of Swiss imports in 1955 and only 3½ per cent in 1959. In the first half of last year Swiss imports of refrigerators from the U.K. amounted to only 360,000 fr out of a total of 18 million fr.

The second most important item is washing machines, where annual imports are at the rate of 25 million fr. There is a good market both for small machines in individual flats and for larger "communal" machines housed in the basements of apartment buildings. Preference is for fully automatic machines with heaters. Price is not a decisive factor here and reliability and quality come first. There are no fewer than 25 Swiss makes. The United Kingdom are doing well with machines of under 100 kg and provide about one-quarter of Swiss imports, two British firms being responsible, but have had very little success with bigger machines. Western Germany lead the field for machines of over 100 kg and supply about three-quarters of Switzerland's total imports of washing machines. According to the trade, machines with enamel drums are virtually unsaleable because the Swiss housewife believes that the hot water takes off the enamel. This excludes one British make, although it is nearly 1,000 fr cheaper than its main Swiss competitor. Swiss and German washing machines have stainless steel drums.

The most important supplier of vacuum cleaners in 1959 was Sweden, followed by Holland, Western Germany and the United Kingdom, in that order. The United Kingdom has done relatively well, however, and supplied 17 per cent of Swiss imports in that year. Swiss production is small.

British manufacturers have done quite well with floor polishers and electric irons, but even here Western Germany leads the field, particularly with irons. Swiss competition is very strong for hair-dryers. There are some popular Swiss food mixers but the German Braun mixer seems to be the most successful in the Swiss market. Dish washing machines are growing in popularity and there are two Swiss manufacturers. Quite good business is being done in spin-dryers. Electric space heaters and cooking stoves were not covered by this inquiry.

Though Western Germany has the advantages of a common language and low transport costs, the main reason why Britain's share of the Swiss market has declined is price. German goods of satisfactory quality seem to be about 5 per cent to 10 per cent cheaper than equivalent British goods.

Secondary factors are advertising and industrial design. Advertising is a problem in Switzerland because there is no radio or television advertising and no national Press. Perhaps the most effective method of advertising is direct mail. Foreign-made goods may not as a rule be exhibited at the major trade fairs in Switzerland but there are frequent opportunities for exhibiting at local fairs. German manufacturers seem to make much more use of these opportunities than British manufacturers.

Swiss standards of design are rather higher than they are in the United Kingdom, and though British goods have quite a good reputation it is thought that designs are retained for too long.

British manufacturers will only regain their share of the Swiss market by making a considerable effort to meet German competition in price and design, by making their products better known and by meeting Swiss requirements.

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## CATALOGUES AND LISTS

**CONTACTS.**—Booklet 1302 (30 pages) dealing with electrical contacts produced by the company.—**Johnson, Matthey & Co., Ltd.,** 73-83, Hatton Garden, London, E.C.1.

**ENGINE TEST GEAR.**—Catalogue containing illustrations and particulars of the company's range of electrically operated testing and tune-up equipment for automobile engines.—**Crypton Equipment, Ltd.,** Bridgwater, Somerset.

**FURNACES.**—Illustrated catalogue describing a selection of the company's standard ranges of industrial-type ovens and furnaces. —**A.E.W., Ltd.,** Imperial Works, High Street, Edgware, Middlesex.

**HEATING.**—Booklet giving information on "Elstein" infra-red equipment for church heating installations.—**P. & R. Electrical (London), Ltd.,** Berrymead Gardens, Acton, London, W.3.

**MINING EQUIPMENT.**—Six pamphlets covering items of mining equipment produced by the company.—**Westinghouse Brake & Signal Co., Ltd.,** 82, York Way, King's Cross, London, N.1.

**RESISTORS.**—Brochure dealing with "Metox" miniature oxide resistors.—**Welwyn Electric, Ltd.,** Bedlington, Northumberland.

**VENTILATION.**—Brochure giving particulars of roof units available with bases to suit most types of roof construction and fitted with "Breeza" heavy duty fans.—**London Fan & Motor Co., Ltd.,** 331, Sandycombe Road, Richmond, Surrey.

**WIRING ACCESSORIES.** — Illustrated 79-page catalogue (W.10) and separate trade price list covering the company's range of wiring accessories, including mercury "sparkless" switches and switch-sockets for hospital operating theatres, and similar situations.—**Wandsworth Electrical Manufacturing Co., Ltd.,** Albert Drive, Sheerwater, Woking, Surrey.

Leaflet (459) on bedside and fireside socket outlets.—**Midland Electric Manufacturing Co., Ltd.,** Tyseley, Birmingham, 11.

Pamphlet describing a new luminous locator for detecting the position of switches and sockets in darkness.—**M.K. Electric, Ltd.,** Shrubbery Road, London, N.9.

# NEW PATENTS

## Electrical Specifications Recently Published

*The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) will be obtainable after 1st March from the Patent Office, 25, Southampton Buildings, London, W.C.2*

**1956**

6498. Young, S. G.—Electrical junction boxes. 28th May, 1957. (862003.)

15962. Associated Electrical Industries, Ltd.—Apparatus for smoke detection. 20th May, 1957. (862147.)

16586/7. Associated Electrical Industries, Ltd.—Stator winding machines. 29th May, 1957. (862054/5.)

**1957**

5137. Associated Fire Alarms, Ltd., and Taylor, W. F.—Electric bells. 13th February, 1958. (861950.)

6931. Unidare, Ltd., and Greer, P. H.—Insulated electric wire conductors. 1st March, 1957. (862006.)

14530. Le Matériel Technique Industriel.—Electrical plug and socket connectors. 7th May, 1957. (861863.)

16277. Robertshaw-Fulton Controls Co.—Computer employing electromechanical balance. 22nd May, 1957. (862000.)

16500. Babcock & Wilcox, Ltd.—Binary fluid power plant. 24th May, 1957. (861924.)

18244. Standard Telephones & Cables, Ltd.—Electric discharge device. 7th June, 1957. (862024.)

19035. Motorola, Inc.—Electromagnetic wave apparatus. 17th June, 1957. (861849.)

19639. Sangamo Weston, Ltd.—Load current meters. 21st June, 1957. (862047.)

20722. Babcock & Wilcox, Ltd.—Tubulous vapour generating and superheating units. 1st July, 1957. (862183.)

21067. Sangamo Weston, Ltd.—Suppressed zero electrical instruments. 3rd July, 1957. (861989.)

27117. A.E.I.-John Thompson Nuclear Energy Co., Ltd.—Nuclear reactors. 14th August, 1958. (861868.)

33745. Associated Electrical Industries, Ltd.—Cable cleats and like supports. 27th October, 1958. (861929.)

35689. Siemens & Halske A.G.—Transistors. 15th November, 1957. (862008.)

36798. Amplivox, Ltd.—Electrical frequency generators. 12th November, 1958. (862133.)

37471. International Business Machines Corporation.—Apparatus for controlling electric currents. 2nd December, 1957. (862178.)

39060. Associated Electrical Industries, Ltd.—Protective covers for electric lamps. 2nd December, 1958. (861881.)

39376. Sogni, G.—Adjustable speed electric motor. 18th December, 1957. (861812.)

39958. Postmaster General.—Subscribers' telephone sets. 17th December, 1958. (862025.)

40276. Elektronische Rechenmaschinen, Wissenschaftlicher Ind. Veb.—Transistor counter. 30th December, 1957. (861913.)

**1958**

2435. Licentia Patent-Verwaltungs-G.m.b.H.—Device for interrupting a.c. substantially when the current wave passes through zero. 24th January, 1958. (862091.)

3635. Grubenlampenwerke Veb.—Electric alkaline accumulators and electrodes thereof. 4th February, 1958. (862092.)

5266. General Electric Co., Ltd., and Runciman, R. D.—Electric switching mechanisms. 4th February, 1959. (861872.)

6254. I.R.S., Ltd.—Illuminating apparatus. 26th February, 1959. (862155.)

7240. Express Lift Co., Ltd.—Acceleration control systems. 6th March, 1959. (861973.)

7305. Associated Electrical Industries, Ltd.—Thermionic valve grids. 4th March, 1959. (861882.)

8189. Racal Engineering, Ltd.—Voltage stabilised electric power supplies. 27th February, 1959. (861974.)

10240. General Electric Co., Ltd.—Nuclear reactors. 18th March, 1959. (861975.)

11930. Elektroschaltgerate Gorlitz Veb.—Incandescent lampholders. 15th April, 1958. (861932.)

12927. Ciba, Ltd.—Electrically insulating sheathing of metals and metallic parts and products obtained thereby. 23rd April, 1958. (862157.)

15335. A.E.I.-John Thompson Nuclear Energy Co., Ltd.—Nuclear reactors. 12th May, 1959. (862125.) 22502. Fuel elements for nuclear reactors. 8th July, 1959. (862208.)

16925. National Research Development Corporation.—Radar systems. 24th August, 1959. (862059.)

17727. Machine Shop Equipment, Ltd.—Control of electric motors. 13th February, 1959. (862096.)

18265. Automatic Telephone & Electric Co., Ltd.—Signal translating circuits for magnetic data recording. 27th May, 1959. (862105.)

18360. Compagnie Industrielle des Piles Electriques.—Deferred action electric battery activatable by immersion in liquid. 9th June, 1958. (861874.)

22514. Evershed & Vignoles, Ltd.—Control of liquid level. 30th June, 1959. (862137.)

22929. General Electric Co., Ltd., and Drybrough D.A.S.—Electrical equipments incorporating transistors. 16th July, 1959. (862099.)

24432. Babcock & Wilcox, Ltd.—Tubulous vapour generating and heating units. 29th July, 1959. (862140.)

25057. British Insulated Callender's Cables, Ltd.—Stranding machines. 5th August, 1959. (862028.)

27050. Standard Telephones & Cables, Ltd.—Selector circuits. 22nd August, 1958. (861921.)

27607. Sursee-Werke A.G.—Electric hotplate unit. 28th August, 1958. (862107.)

29276. General Electric Co., Ltd.—Electrically operated solid fuel igniters. 30th July, 1959. (862063.)

30035. Babcock & Wilcox, Ltd.—Apparatus for ultrasonically testing butt welds. 18th September, 1959. (862031.)

38701. Bendix Corporation.—Electrical apparatus. 1st December, 1958. (862144.)

39185. Associated Electrical Industries, Ltd.—Cathode-ray tube screens. 30th November, 1959. (861885.)

**1959**

2260. Licentia Patent-Verwaltungs G.m.b.H.—Steam power installation for nuclear power plant with gas cooled reactors. 21st January, 1959. (861891.)

3180. Grand, C.—Interlocked contactor for the control and reversal of three-phase electric motors. 29th January, 1959. (862129.)

3272. Koehler Manufacturing Co.—Battery charging apparatus. 29th January, 1959. (862130.)

5909. Electrolux A.B.—Washing machines. 20th February, 1959. (861917.)

6409. Vitro Corporation of America.—Nuclear reactors. 24th February, 1959. (862145.)

12382. Westinghouse Electric Corporation.—Adjustable speed a.c. electric motor drives. 13th April, 1959. (861955.)

13251. Naimer, H. L.—Flush-fitting wall boxes for electrical equipment. 17th April, 1959. (861908.)

13566. General Electric Co.—Polyethylene insulated electrical conductor. 21st April, 1959. (861839.)

14221. Westinghouse Electric Corporation.—Dynamo-electric machines. 27th April, 1959. (861956.)

15856. Harvey Hubbell, Inc.—Cover plate for an electric switch wall box. 8th May, 1959. (861801.)

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# TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 1st March:—

**Viking.** No. 800,671. Class 7. Washing, drying and rinsing machines; hair drying machines; and electrical machines for domestic purposes.—North Western Specialities, Ltd., Castle Works, Stalybridge, Ches.

**Gyro-flow** (design). No. B803,648. Class 7. Fans (parts of air-purifying and fanning machines.—Midland Heating & Ventilation Co., Ltd., Bedford Road, Birmingham, 11.

**Retriever.** No. 810,324. Class 7. Electrically operated lifting and stacking apparatus.—Triax Company, Cleveland, Ohio, U.S.A. Address for service: Marks & Clerk, 57/8, Lincoln's Inn Fields, London, W.C.2.

**Glidemaster.** No. 810,327. Class 8. Electric shavers.—Sunbeam Corporation, Chicago, U.S.A. Address for service: Frank B. Dehn & Co., Kingsway House, 103, Kingsway, London, W.C.2.

Design (three T's in outline). No. 784,286. Class 9. Electrical apparatus and instruments; and measuring, signalling, sound recording and checking (supervision) apparatus and instruments.—Tyer & Co., Ltd., Perram Works, Merrow Siding, Guildford, Surrey.

**Atcotran.** No. 792,673. Class 9. Electrical, electronic, electro-hydraulic, electro-pneumatic and electro-mechanical apparatus for use in the automatic remote control of industrial equipment; electrical differential transformers; relays, etc.—Automatc Timing & Controls, Inc., Pennsylvania, U.S.A. Address for service: Baron & Warren, 16, Kensington Square, London, W.8.

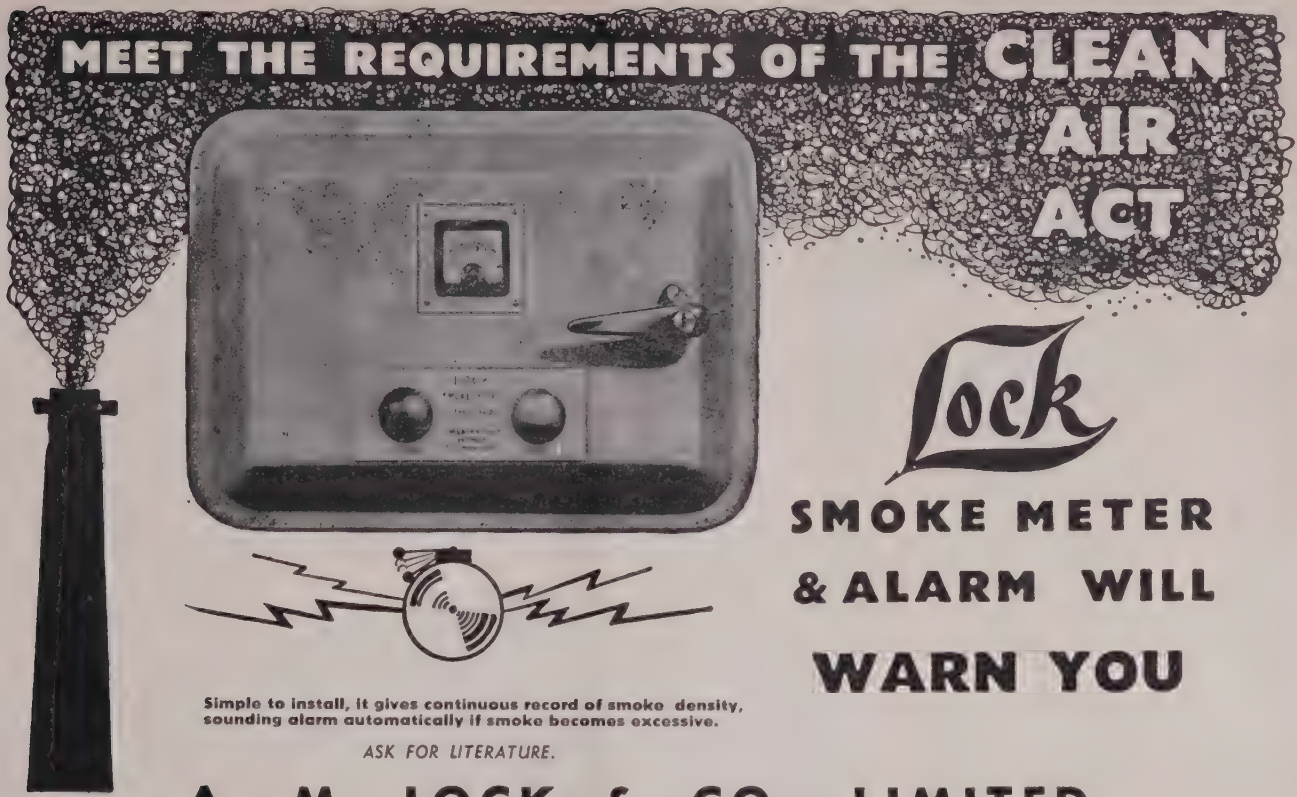
**Vibret.** No. 807,103. Class 9. Electronic measuring instruments.—Electronic Instruments, Ltd., Lower Mortlake Road, Richmond, Surrey.

**Executive.** No. 807,481. Class 9. Electric lighters.—Dorset Light Industries, Ltd., 88, East Street, Bridport, Dorset.

**Sparkonite.** No. 807,905. Class 9. Electrodes for spark machining.—Mallory Metallurgical Products, Ltd., 78, Hatton Garden, London, E.C.1.

**Robophone.** No. 809,724. Class 9. Apparatus for incorporation in telephone receiving circuits for automatically recording messages by means of magnetic tape.—Automaton Telephones (London), Ltd., 32, Orkney Street, London, S.W.11.

**Five Rings** (design). No. 810,791. Class 11. Electric torches and electric lamps.—Grandeur Aluminiumware Manufacturing Co., Ltd., Hong Kong. Address for service: Cope & Co., 65, Victoria Street, London, S.W.1.



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# NEXT WEEK'S EVENTS

*Organisers of electrical functions are advised to make use of the " Electrical Review " clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged*

## MONDAY, 13th FEBRUARY

**Birmingham.**—College of Advanced Technology, Gosta Green, 6 p.m. I.E.E. South Midland Supply and Utilisation Group. " The Application of Low-Pressure Resins to some High-Voltage Switchgear Designs," by T. R. Manley, K. Rothwell and W. Gray.

**Bournemouth.**—Grand Hotel, Firvale Road, 8 p.m. A.S.E.E. Bournemouth and District Branch. " Lighting—the Background of Research," by S. S. Beggs.

**Bristol.**—Electricity House, 6 p.m. I.E.E. Western Centre. " Surge Flashover Voltages of Air Gaps Associated with Insulators and Bushings," by G. W. Bowdler and R. C. Hughes.

**Glasgow.**—Royal College of Science and Technology, 6 p.m. I.E.E. Scottish Electronics and Measurement Group. " Development of the Formulæ of Electromagnetism in the M.K.S. System," by Dr. P. Vigoureux.

**London.**—Savoy Place, W.C.2, 6 p.m. Institution of Electrical Engineers. Informal meeting. Discussion: " The Road to Corporate Membership: What is the Responsible Experience Required ? " to be opened by A. H. Mumford and D. S. Rolfe. (Joint meeting with the London Graduate and Student Section.)

White Hall Hotel, Bloomsbury Square, W.C.1, 7.15 p.m. A.S.E.E. Central London Branch. " Operation of Reactors," by A. L. Shaw.

**Manchester.**—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North Western Centre. Discussion on " Laboratory Work for the Institution Examination," to be opened by Dr. P. F. Soper.

**Newcastle-on-Tyne.**—Neville Hall, 6.30 p.m. I.E.E. North Eastern Centre. " Protection of High-Voltage Insulators from Power-Arc Damage," by Dr. A. E. Guile.

**Sheffield.**—Grand Hotel, 6.30 p.m. I.E.S. Sheffield Centre. Presidential address by W. S. Stiles.

**Wembley.**—Century Hotel, 8.15 p.m. A.S.E.E. North West London Branch. " Under-floor Heating," by R. D. Jackson.

## TUESDAY, 14th FEBRUARY

**Aldershot.**—Queen's Hotel, High Street, 8 p.m. A.S.E.E. Aldershot and District Branch. " Electical Testing Instruments."

**Bedford.**—Swan Hotel, 7 p.m. I.E.E. Bedfordshire Sub-Centre. Discussion on " Machine Tool Control," to be opened by Dr. E. H. Frost-Smith.

**Belfast.**—David Keir Building, Queen's University, Stranmillis Road, 6.30 p.m. I.E.E. Northern Ireland Centre. " A Survey of Street Lighting and its Future," by W. R. Stevens and H. M. Ferguson.

**Birmingham.**—College of Technology, Gosta Green, 6 p.m. I.E.E. South Midland Centre. Discussion on " Courses at Technician Level on Automatic Control," to be opened by J. W. S. Payne.

**Broadstairs.**—Clarendon Hotel, 8 p.m. A.S.E.E. East Kent Branch. " Oil-fired Boilers and Associated Equipment," by S. Austin.

**Cardiff.**—Park Hotel, Park Place, 7.30 p.m. A.S.E.E. South Wales Branch. " Electrical Safety," by S. J. Emerson.

**Chester.**—Westminster Hotel, City Road, 7.45 p.m. A.S.E.E. Chester and District Branch. " Application of Electricity in a Modern Waterworks," by D. C. Summerton.

**Edinburgh.**—Carlton Hotel, 7 p.m. I.E.E. Scottish Electronics and Measurement Group. " Development of the Formulæ of Electromagnetism in the M.K.S. System," by Dr. P. Vigoureux.

**Glasgow.**—Kenilworth Hotel, Queen Street, 8 p.m. A.S.E.E. Glasgow Branch. " Telephone Equipment."

**Hull.**—Y.E.B. Offices, Ferensway, 6.30 p.m. I.E.E. North Midland Centre. " The Characteristics and Protection of Semiconductor Rectifiers," by D. B. Corbyn and N. L. Potter.

**Leeds.**—College of Engineering and Science, Cookridge Street, 6.30 p.m. I.E.E. North Midland Centre. Discussion on " The Place of the Technical Institute in the National Certificate Scheme," to be opened by R. L. Wilkinson.

**London.**—Grosvenor House, 6.30 for 7 p.m. Electrical Contractors' Association. Annual dinner.

Connaught Rooms, W.C.2, 12.30 for 1 p.m. Electrical Industries Club. Luncheon. Speaker, A. Albu, M.P.

Savoy Place, W.C.2, 6 p.m. I.E.E. Education Discussion Circle. " Technical Teacher Training," to be opened by F. T. Chapman.

London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 5.30 p.m. Brit.I.R.E. Electro-Acoustics Group. " Some Psycho-Acoustic and Engineering Aspects of Hearing Aid Design," by J. Jessop.

Royal Society of Arts, John Adam Street, Adelphi, Strand, W.C.2, 6.30 p.m. Institution of Plant Engineers. Annual general meeting followed by a discussion " Underfloor Heating."

**Loughborough.**—College of Further Education, Greenclose Lane, 6.30 p.m. I.E.E. East Midland Electronics and Control Group. " Electronic Telephone Exchanges," by J. R. Pollard.

**Manchester.**—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North Western Centre. " Silicon Power Rectifiers," by A. J. Blundell, A. E. Garside, R. G. Hibberd and I. Williams.

Engineers' Club, Albert Square, 7.15 p.m. Institution of Plant Engineers, Manchester Branch. " The Introduction of Planned Maintenance Systems," by A. F. Stedman.

Nag's Head, Jacksons Row, 6.45 p.m. Society of Instrument Technology, Manchester Section. " Modern Railways Signalling Methods," by C. S. Shute.

**Newcastle-upon-Tyne.**—Roadway House, Oxford Street, 7.30 p.m. A.S.E.E. Newcastle-upon-Tyne and District Branch. " Variable Speed Motors."

Old Assembly Rooms. North East Electrical Club. Ladies' night.

**Nottingham.** — Nottingham Mechanics' Institution, Trinity Square, 7.30 p.m. A.S.E.E. Nottingham Branch. " Recent Developments in Variable Speed A.C. Motors," by J. C. H. Bone.

**Portsmouth.**—Guildhall, 6.30 p.m. I.E.E. Southern Centre. Faraday Lecture. " Transistors—and All That," by L. J. Davies.

Ministry of Labour Office, Lake Road, 7.30 p.m. A.S.E.E. Portsmouth and District Branch. " Planned Maintenance."

**York.**—Royal Station Hotel, 7.30 p.m. A.S.E.E. York Branch. " Electrical Safety in the Home and Factory," by F. Clark.

## WEDNESDAY, 15th FEBRUARY

**Bristol.**—The University. I.E.E. Bristol Graduate and Student Section. " The Aims and Object of the Institution."

College of Science and Technology, 7 p.m. Brit.I.R.E. Bristol Section. " High Speed Digital Applications of Transistors," by M. L. N. Forrest.

**Chelmsford.** — Hoffmann Manufacturing Co., Ltd., 7.30 p.m. Institution of Production Engineers, South Eastern Region. " New Welding Techniques," by G. Cubitt-Smith.

**London.**—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Supply Section. " A General Theory of Depreciation of Engineering Plant," by D. Rudd.

Geological Society, Burlington House, Piccadilly, W.1, 5.30 p.m. Institution of Chemical Engineers. Hinchley Memorial Lecture. " Science and Technology and the Developing Countries," by Prof. P. M. S. Blackett.

**Maidstone.**—Queen's Head Hotel, 7 p.m. Institution of Plant Engineers, Kent Branch. " Smut Emission from Oil-Fired Boilers."

**Manchester.**—Engineers' Club, 7 p.m. I.E.E. North Western Centre, Graduate and Student Section. " Colour Television," by P. S. Carnt.

**Rugby.**—College of Engineering Technology, 6.30 p.m. I.E.E. Rugby Sub-Centre. " An Electrostatic Dust Monitor," by Dr. D. H. Grindell.

**Sheffield.**—The University, Mappin Street, 6.30 p.m. I.E.E. North Midland Centre. Sheffield Sub-Centre. " Thermistors, their Theory, Manufacture and Application," by R. W. A. Scarr and R. A. Setterington.

**Torquay.**—S.W.E.B. Electric Hall, 3 p.m. I.E.E. South Western Sub-Centre. " Theory of the Travelling Wave Parametric Amplifier," by Prof. A. L. Cullen.

**Wolverhampton.**—Chamber of Commerce, District Bank Chambers, Lichfield Street, 7.45 p.m. A.S.E.E. Wolverhampton and District Branch. " Forensic Science and the Detection of Crime," by Detective Chief Inspector Aston.

## THURSDAY, 16th FEBRUARY

**Bristol.**—Royal Hotel, College Green, 10 a.m. Combustion Engineering Association. Discussion on " Factors Affecting the Choice of New Boiler Plant," to be opened by W. Short.

**Cardiff.**—Institute Buildings, Park Place, 6 p.m. South Wales Institute of Engineers. " The Single Conductor Multi-channel Signalling and Telemetering System," by F. C. Riches.

**Dublin.**—Physical Laboratory, Trinity College, 6 p.m. I.E.E. Irish Branch. " Research on the Performance of High-Voltage Insulators in Polluted Atmospheres," by Dr. J. S. Forrest, P. J. Lambeth and D. F. Oakeshott.

**Glasgow.**—39, Elmbank Crescent, C.2, 7.30 p.m. Institution of Production Engineers, Northern Region. Annual general meeting followed by " Some Industrial Applications of Magnetic Power," by T. G. Hawker.

**London.**—Central Hall, Westminster, 6 p.m. I.E.E. Faraday Lecture. " Transistors—and All That," by L. J. Davies.

Royal Institution, 6.30 p.m. Plastics Institute, London and District. " Swinburne Award Address," by Prof. G. Gee.

**Sunderland.**—Technical College, 6.30 p.m. I.E.E. North Eastern Graduate and Student Section. " Automatic Position Control of a Machine Tool," by N. S. Blyth.

**Weymouth.**—South Dorset Technical College, 6.30 p.m. I.E.E. Southern Centre. " Silicon Controlled Rectifiers," by D. D. Jones.

## FRIDAY, 17th FEBRUARY

**Cardiff.**—South Wales Institute of Engineers, 7 p.m. I.E.E. Cardiff Graduate and Student Section. " Parametric Amplification," by V. David.

**Hanley.**—Grand Hotel, 7.30 p.m. A.S.E.E. Stoke and Crewe Branch. " Light as an Aid to Industrial Production," by T. Catten.

**London.**—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Electronics and Communications Section. " A Comprehensive Introduction to Plasma Physics," by W. B. Thompson.

**Nottingham.**—Victoria Station Hotel, 7 for 7.30 p.m. I.E.E. East Midland Centre. Dinner-dance.

**Plymouth.** — Guildhall. I.E.E. South Western Sub-Centre. Dance.

**Southampton.**—Royal Hotel, 8 p.m. to 1 a.m. Institution of Plant Engineers, Southern Branch. Annual supper-dance.

**Stone.**—Crown Hotel, 7 for 7.30 p.m. I.E.E. North Staffordshire Sub-Centre. Annual dinner.

# CONTRACT INFORMATION

## Accepted Tenders and Prospective Electrical Work

### CONTRACTS OPEN

*Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses*

**Australia.**—State Electricity Commission of Victoria, Melbourne. 8th March. Two 18 MVA 16·5/6·6 kV transformers, twelve 1,000 kVA 6·6 kV/415 V station service units and fire-fighting equipment. (E.S.B. 2755/61.)*

Western Australia Government Tender Board, Perth. 9th March. 66 kV circuit-breakers. (E.S.B. 2737/61.)*

**Braintree.**—U.D.C. 3rd March. Electrical installation at the Institute. (See this issue.)

**Carshalton.**—U.D.C. 1st March. Street lighting columns and equipment. (See this issue.)

**Ceylon.**—Department of Government Electrical Undertakings. 14th March. Diesel engine generating sets, transmission lines and distribution system at Minneriya. (E.S.B. 3085/61.)*

**Dewsbury.**—Corporation. 28th February. Street lighting equipment. (See this issue.)

**Durham.**—County Council. Electrical installation work at Denton C.E. School, Frosterley South County School, Jarrow Dunn Street County School, Peterlee Eden Hall County School, Rookhope County School, and Wearhead County School. County architect, South Street, Durham.

**Egypt.**—Thermo-electric exchange and salt water distillation plant. Closing date for tenders postponed to 1st April. (E.S.B. 479/61.)*

**Formosa.**—Central Trust of China. 24th February. Capacitor units. (E.S.B. 3100/61/I.C.A.)* 27th February. Power condensers. (E.S.B. 3601/61/I.C.A.)*

**India.**—Durgapur Project. 20th February. 132 kV double-circuit transmission line. (E.S.B. 3011/61.)*

National Coal Development Corporation, Ltd. 8th March. Four electric vibratory feeders. (E.S.B. 2730/61.)*

Locomotive Component Works, Calcutta. 23rd March. Electric lifting hoists and swivelling jib. (E.S.B. 3030/61.)*

**Irish Republic.**—28th February. Electrical installation in new primary school, Ballinacurra Weston, Limerick. J. C. Thompson, architect, 65, O'Connell Street, Limerick.

**Keighley.**—Corporation. 6th March. Group "A" street lighting installation. (See this issue.)

**Margate.**—Borough Council. 18th February. Supply of electric lamps and fluorescent tubes, electrical fittings, cable, etc., for the year ending 31st March, 1962 (Form No. 5). Borough engineer, 38, Grosvenor Place.

**Newcastle-on-Tyne.**—City Council. Electrical repairs and maintenance work in 29,000 Council houses during the year commencing 1st April. City architect.

**Ossett.**—Borough Council. 28th February. Electrically operated sewage pumping plant in duplicate. Arnold Brooksbank & Son, consulting engineers, 48, Sunbridge Road, Bradford, 1.

**Rhodesia and Nyasaland.**—Bulawayo Electricity Department. 1st March. Six three-panel, 11 kV, 250 MVA switchboards and four ring main units. (E.S.B. 3005/61.)*

**Saltburn and Marske (Yorks).**—U.D.C. 18th February. Electrical installations in 20 flats, Marine Parade, Saltburn. Council's surveyor.

**South Vietnam.** — Central Purchasing Authority. 3rd March. Telephone wire and cable. (E.S.B. 3092/61.)* Electrolytic copper wire and cable. (E.S.B. 3093/61.)* Copper conductors. (E.S.B. 3094/61.)*

**Sudan.**—Central Electricity and Water Administration, Khartoum. 21st February. Electrical wires. (E.S.B. 2782/61.)*

**United States.**—Bureau of Reclamation, Denver. 28th February. Two 161 kV circuit-breakers. (E.S.B. 3079/61.)*

**West Hartlepool.**—Borough Council. 22nd February. Electrical installation in High School for Girls. L. Auton, architect, Regent Buildings, York Road, West Hartlepool.

### ORDERS PLACED

**Birmingham.**—Regional Hospital Board. Recommended. Electrical mains reorganisation at the Powick Hospital, Worcester (£21,049).—Abell & Smith's Electrical Co. Electrical services in Block "A" at Solihull Hospital (£5,712).—F. Burton. Electrical services in the gynæcological department at the General Hospital, Burton-on-Trent (£3,301).—W. T. Parker.

**Douglas (I.o.M.).**—Corporation. Diesel alternator set for Pulrose power station (£62,703).—Mirrlees, Bickerton & Day.

**London.**—County Council. Three passenger lifts at the London School of Printing and Graphic Arts, Southwark (£40,945) and two in dwellings at Mountmorres Road, Stepney (£12,830).—Express Lift Co.

**Manchester.**—Regional Hospital Board. Recommended. Rewiring of wards at Park Hospital, Davyhulme (£5,778).—E. Lee & Co.

### WORK IN PROSPECT

*Particulars of new works and building chemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors*

**Ashford (Middx.).** — Out-patients' and casualty block, General Hospital; Huckle & Durkin, architects, 30, Queen Anne Street, London, W.1.

**Banbury.** — Physiotherapy department, Horton General Hospital; Nuttall, Lucas & Partners, architects, 46a, High Street.

**Bedford.**—First phase of £250,000 North Beds. Selective School; county architect, Bedford.

Municipal offices (six-storey block); borough engineer, Newnham House, Horne Lane.

**Bishop Auckland.**—Covered swimming baths; Cackett, Burns Dick & Mackellar, architects, 21, Ellison Place, Newcastle-on-Tyne.

**Canterbury.**—Three blocks of maisonnettes, Spring Lane estate; city architect.

**Cheshire.**—College of Further Education at Crewe and Technical College at Hyde; county architect, Chester.

**Crook (Co. Durham).**—Office block, New Road, for Estates Management Corporation, Team Valley, Gateshead; Fennell & Baddiley, architects, Bridge End Chambers, Chester-le-Street.

**Doncaster.**—Maternity and child welfare clinic, Chequer Road; borough surveyor.

**Durham.**—Aged people's hostels at Stockton and Newton Aycliffe; county architect, South Street, Durham.

**Eastbourne.**—Central library and block of offices, Grove Road; borough surveyor, 2/4, Saffrons Road.

**Enfield.**—Church, Camlet Way; Dodds & White, architects, 45, Queen Anne Street, London, W.1.

Works, Suez Road; Arlington Motor Co., Ltd., High Street, Ponders End.

**Gateshead.**—Proposed junior school at Wrekenton; G. F. Winters, borough engineer.

**Guildford.**—Factory, trading estate; R. Holford & Sons, Ltd., Walnut Tree Works.

**Hebburn (Co. Durham).**—Houses (100); U.D.C. surveyor.

**Hinckley.**—Factory extension; A. G. Minard & Sons, Ltd., High Street, Earl Shilton.

**Ipswich.**—Dwellings (164), Chantry estate; borough engineer.

**Jarrow.**—Factory (£35,000); Neolith, Ltd., 157, Elswick Road, Newcastle-on-Tyne.

**Keighley.**—Flats (192), Broom Street; E. G. Felgate, architect, College Street.

**London.**—Office block, 207/17, Lavender Hill, Battersea; J. E. Greatorex & Partners, consulting engineers, 15, Berners Street, W.1.

Hotel, 380/386, Kensington High Street; Messervy & Messervy, architects, 12, Poultry, E.C.2.

Prince Charles Theatre and showrooms and offices, Lisle Street and Leicester Place; Carl Fisher, architect, 56, Portland Place, W.1.

**Longbenton (Northumberland).** — Houses (46), Burradon; U.D.C. surveyor, Council Offices, Forest Hall, Newcastle-on-Tyne.

**Middlesbrough.**—Soft drinks factory, Simpson Street, for Gray Brothers; J. V. Spencer, architect, Albert Road.

**Neath.**—Factory; Forth Chemical Co., Ltd., Devonshire House, Mayfair Place, London, W.1.

**North Shields.**—Factory extensions for Tyne Brand Products, Ltd., Brewhouse Bank; Tasker & Partners, architects, 25, New Bridge Street, Newcastle-on-Tyne.

**Nuneaton.**—Proposed abattoir, meat market and cold store (£135,000); borough surveyor.

**Oldbury.**—New gymnasium block at Albright Secondary Modern School; borough surveyor, Municipal Bank Chambers, Birmingham Street.

**Peterlee.**—Houses (106), Chapel Hill estate; Architect's Department, Peterlee Development Corporation, Shotton Hall.

**Rutherglen.**—Houses (24), Fernhill; J. C. Russell, burgh surveyor, Town Hall Buildings.

**Saffron Walden.**—Extension to training college (£120,000); R. H. Turner, architect, 97, Coombe Road, New Malden.

**St. Albans.**—Nurses' home, Napsbury Hospital; Eric G. Broughton, architect, 48, Haven Green, London, W.5.

**Scarborough.**—Factory, Eastfield; D. H. Greaves, Ltd., Oriel Works.

**Sunderland.**—Conversion of the Regent Cinema, Ryhope Road, into self-service stores, with flats above; S. John Hill & Partners, architects, 2, Whitfield Street, Gloucester.

**Tiverton.**—Houses (84), The Walronds; Beech & Cooke, architects, 15, Dix's Field, Exeter.

**Tynemouth.**—Offices for Smith's Dock Co., Ltd., North Shields; W. B. Edwards & Partners, architects, Claremont Buildings, Newcastle-on-Tyne.

Commercial garage, showroom, workshop, etc., at New York Road, Tynemouth, for Rockcliffe Garage, Front Street, Cullercoats.

**West Hartlepool.** — Reconstruction of Greatham Hospital; F. F. Johnson, architect, 16, High Street, Bridlington.

**West Sussex.**—New infants' school at Bognor Regis and extensions to Bognor Regis William Fletcher Secondary Modern School; county architect, County Hall, Chichester.

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* This information is extracted from the Board of Trade *Export Service Bulletin.* Inquiries should be addressed to the Board of Trade, Export Services Branch, Lacon House, Theobald's Road, London, W.C.2 (Telephone: Chancery 4411, Ext. 738), quoting the reference given.

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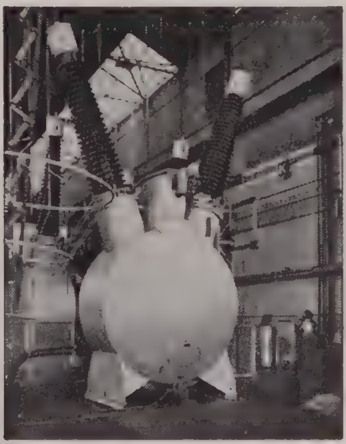

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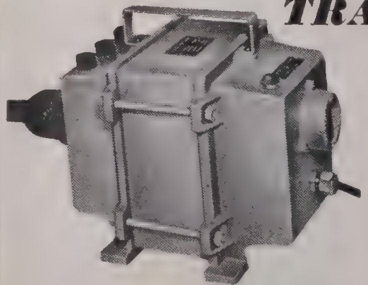

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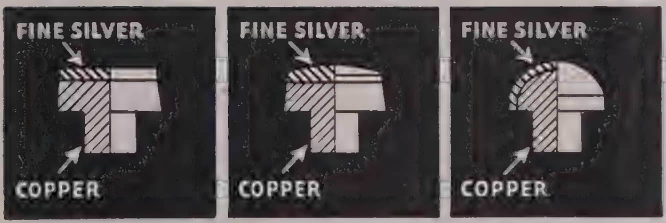

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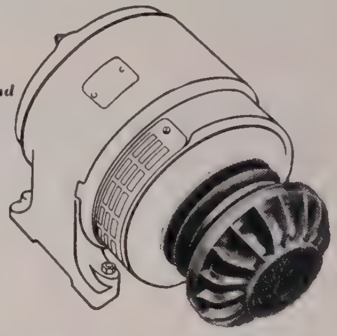

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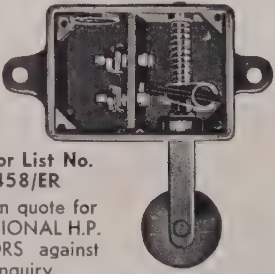

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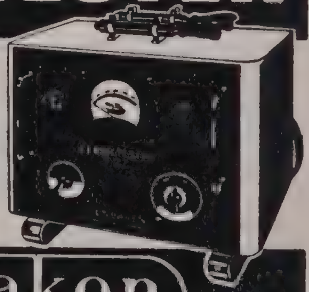

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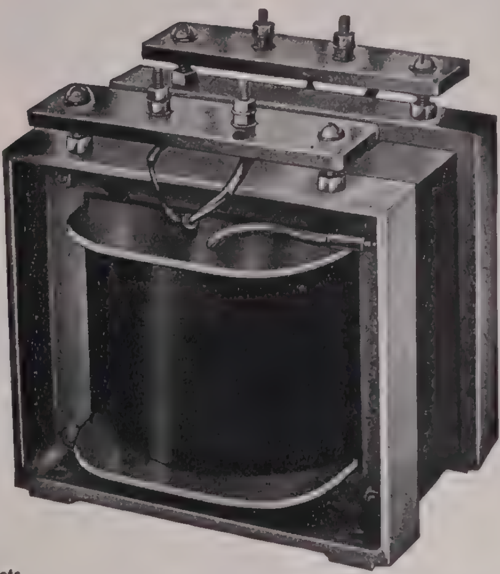

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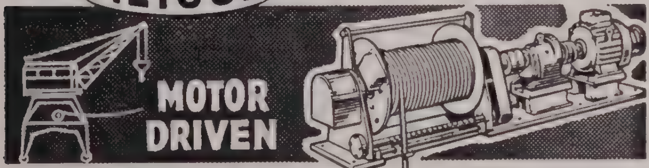

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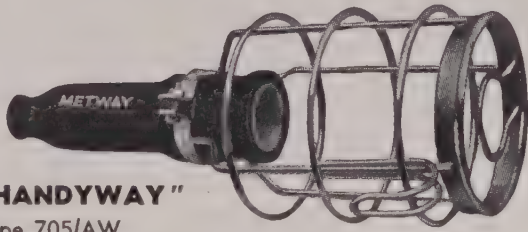

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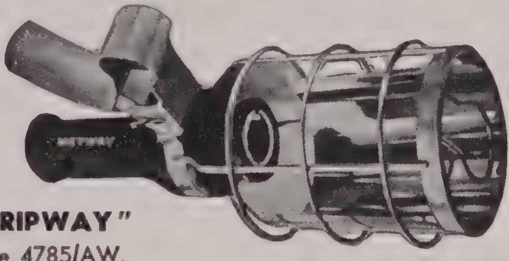

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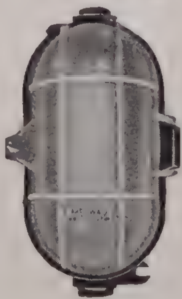

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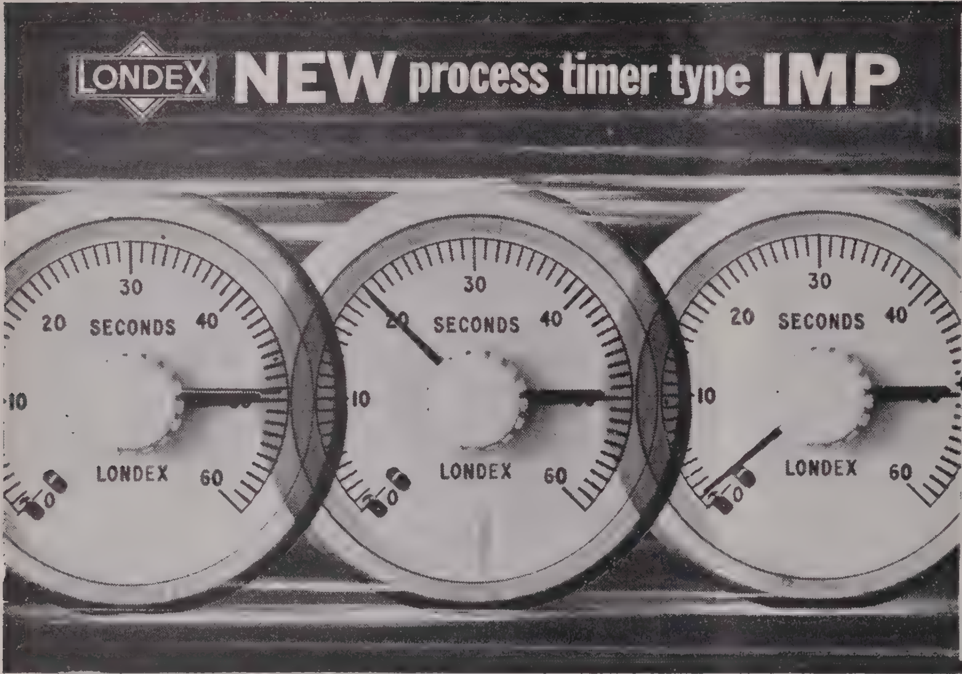

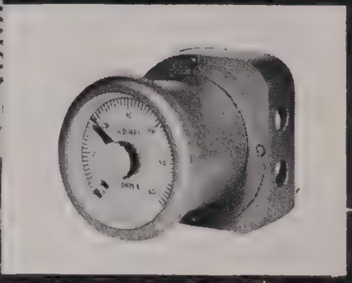

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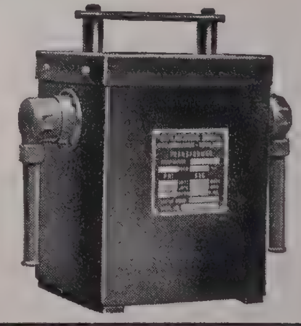

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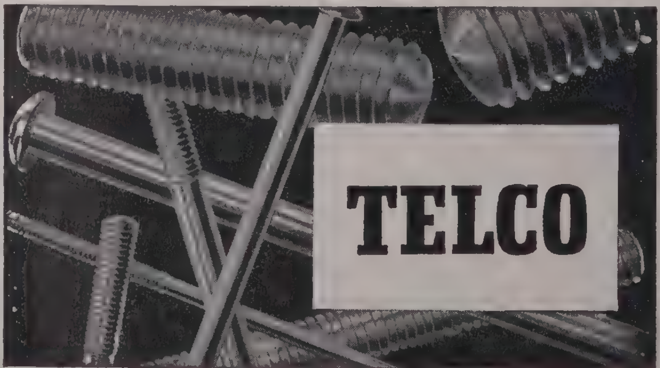

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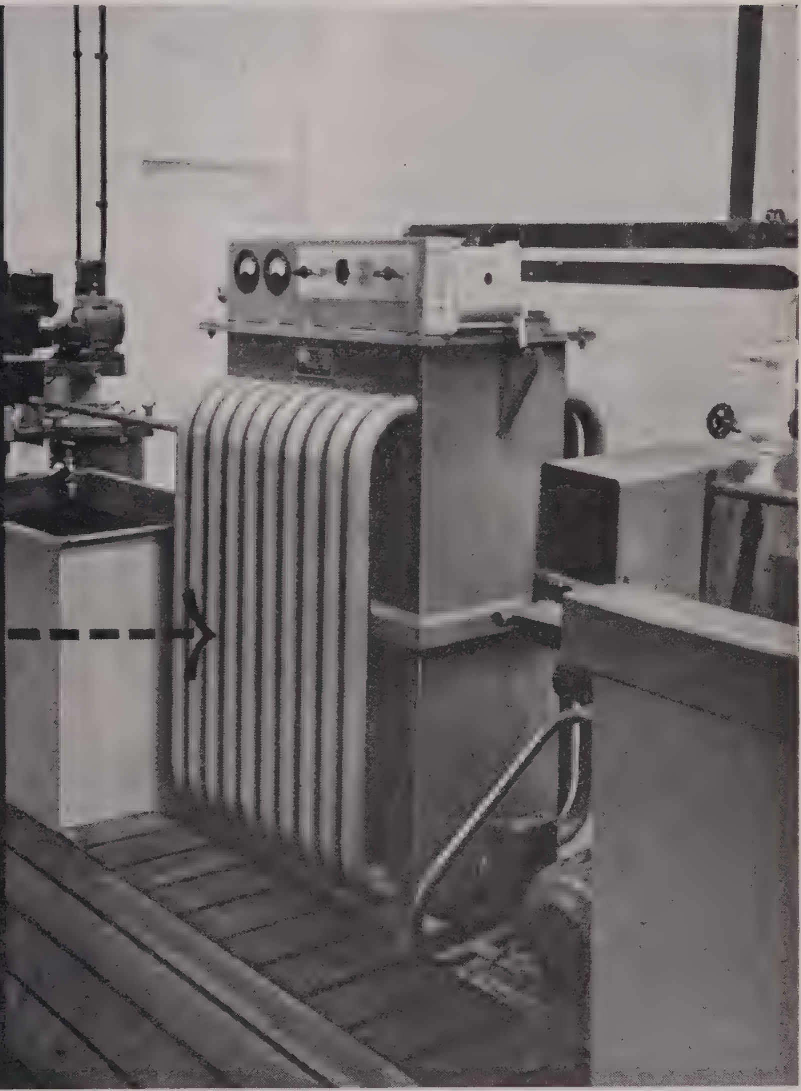

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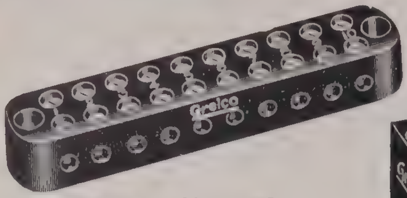

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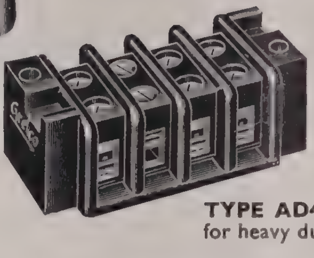

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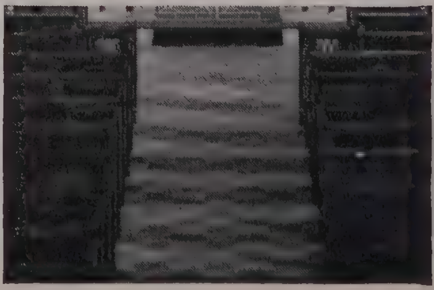

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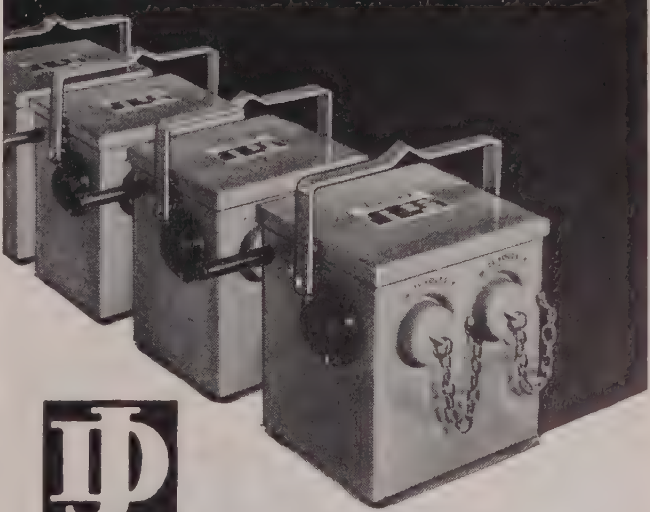

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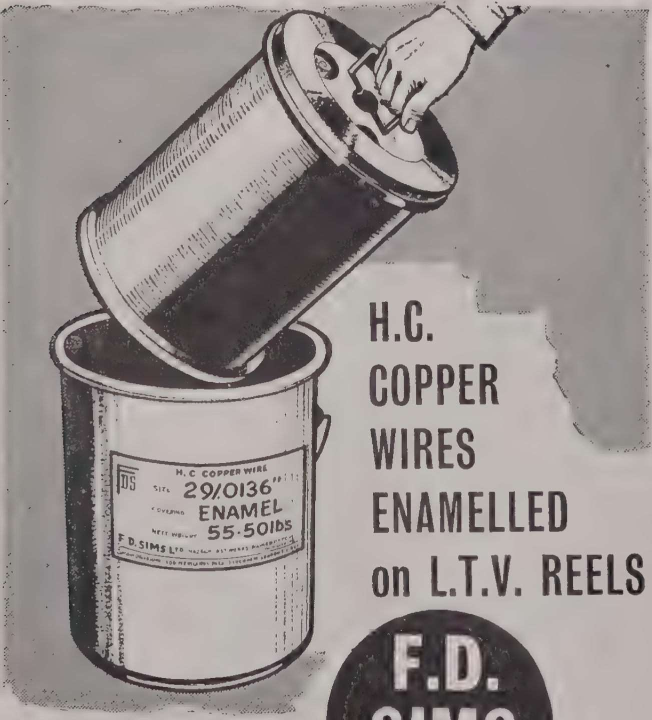

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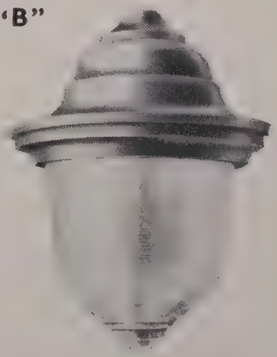

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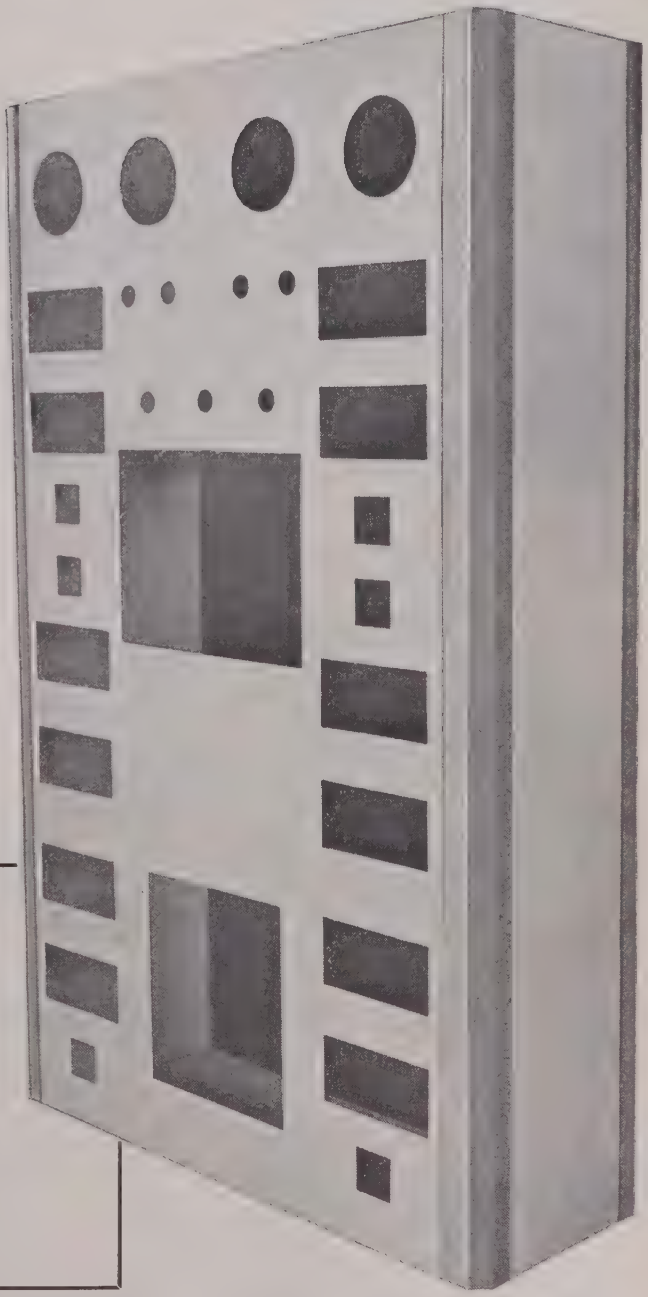

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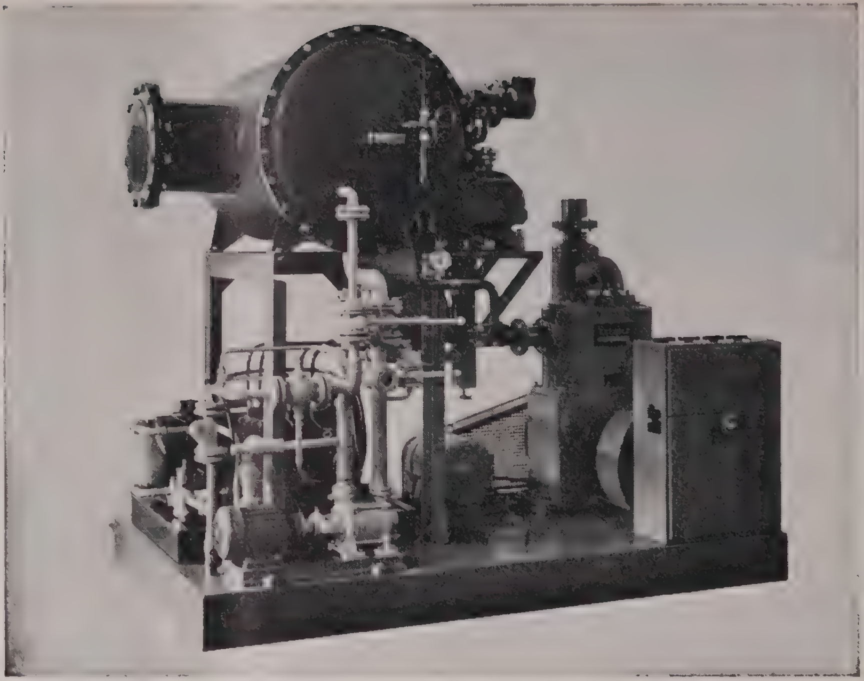

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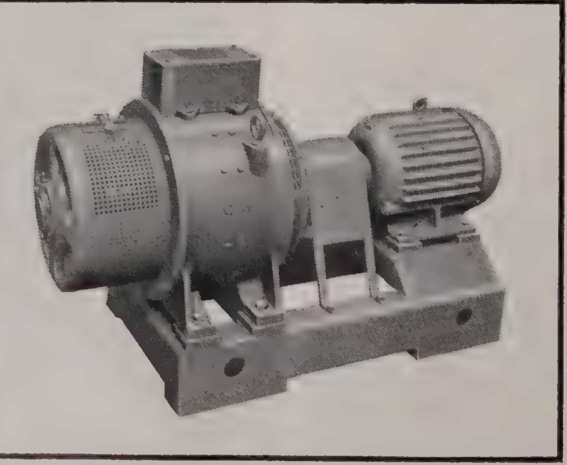

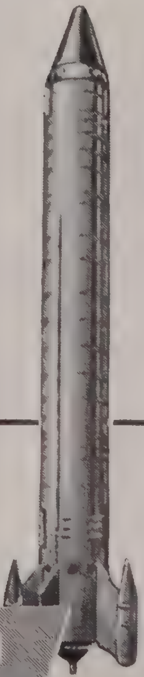

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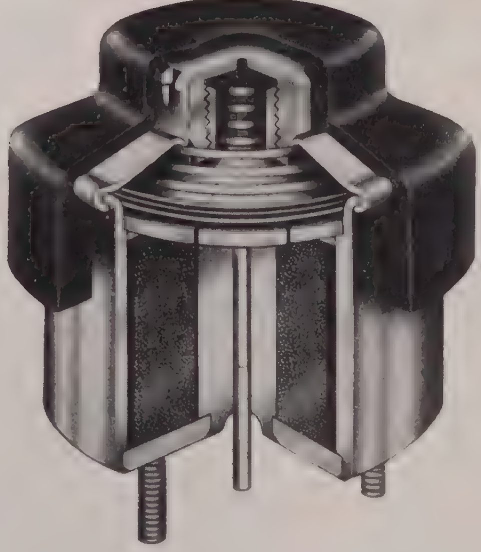

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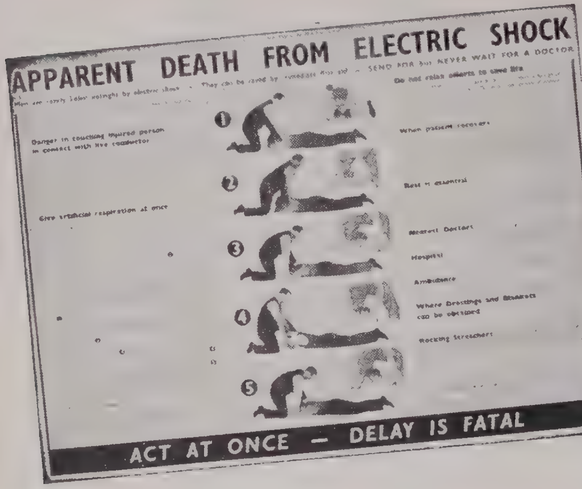

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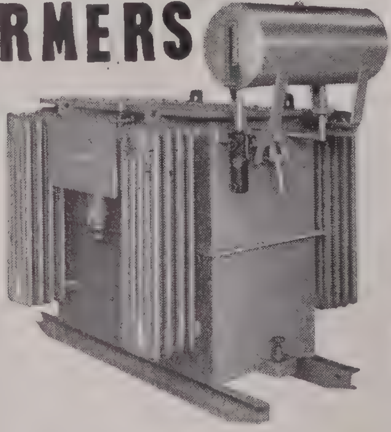

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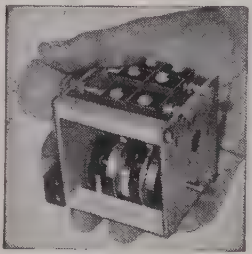

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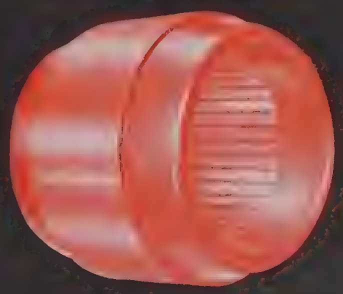
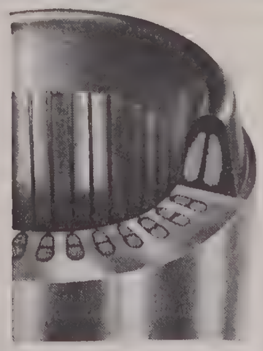


This illustration of the stator winding shows how the epoxy encapsulation completely covers and protects the coils.



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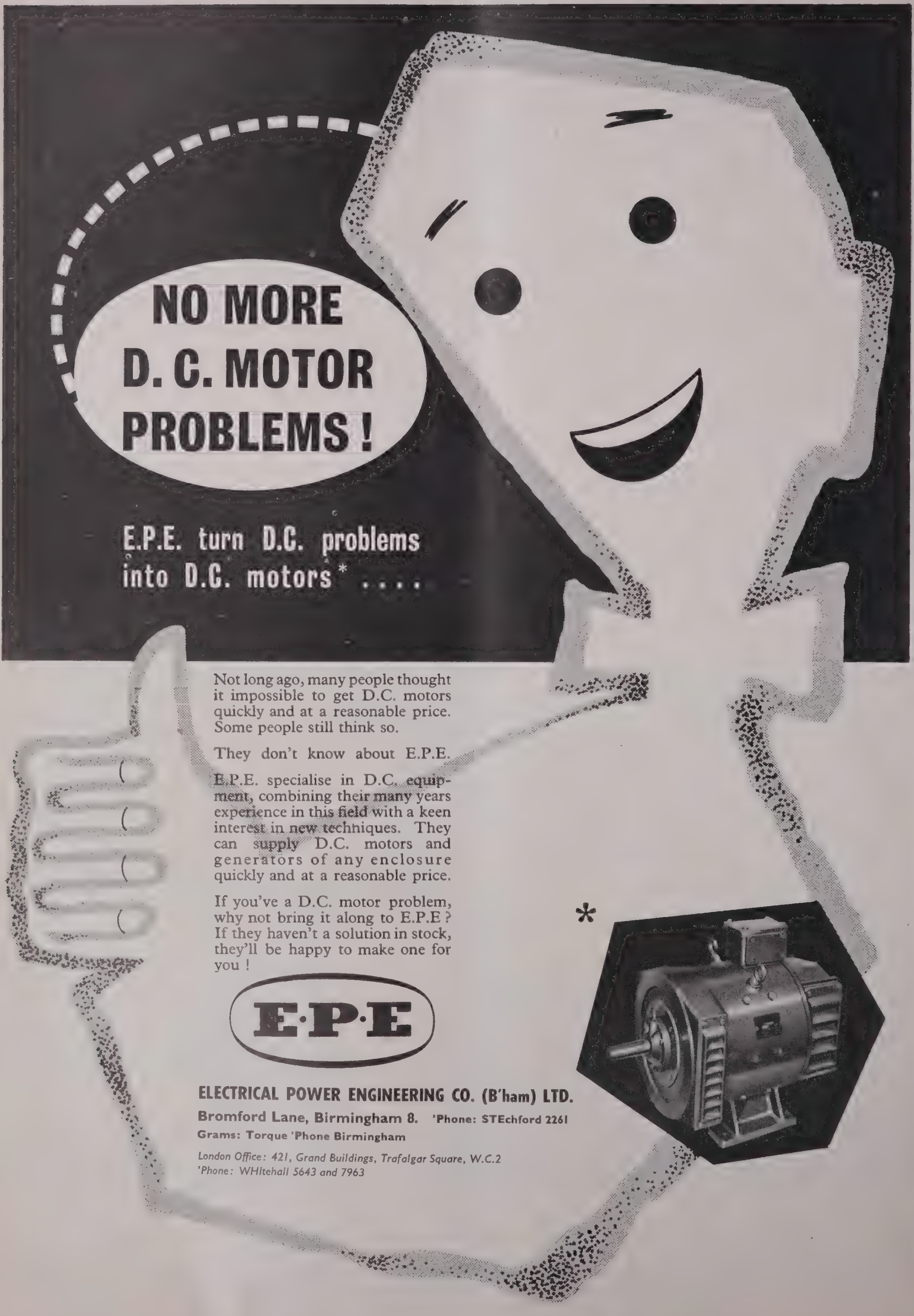

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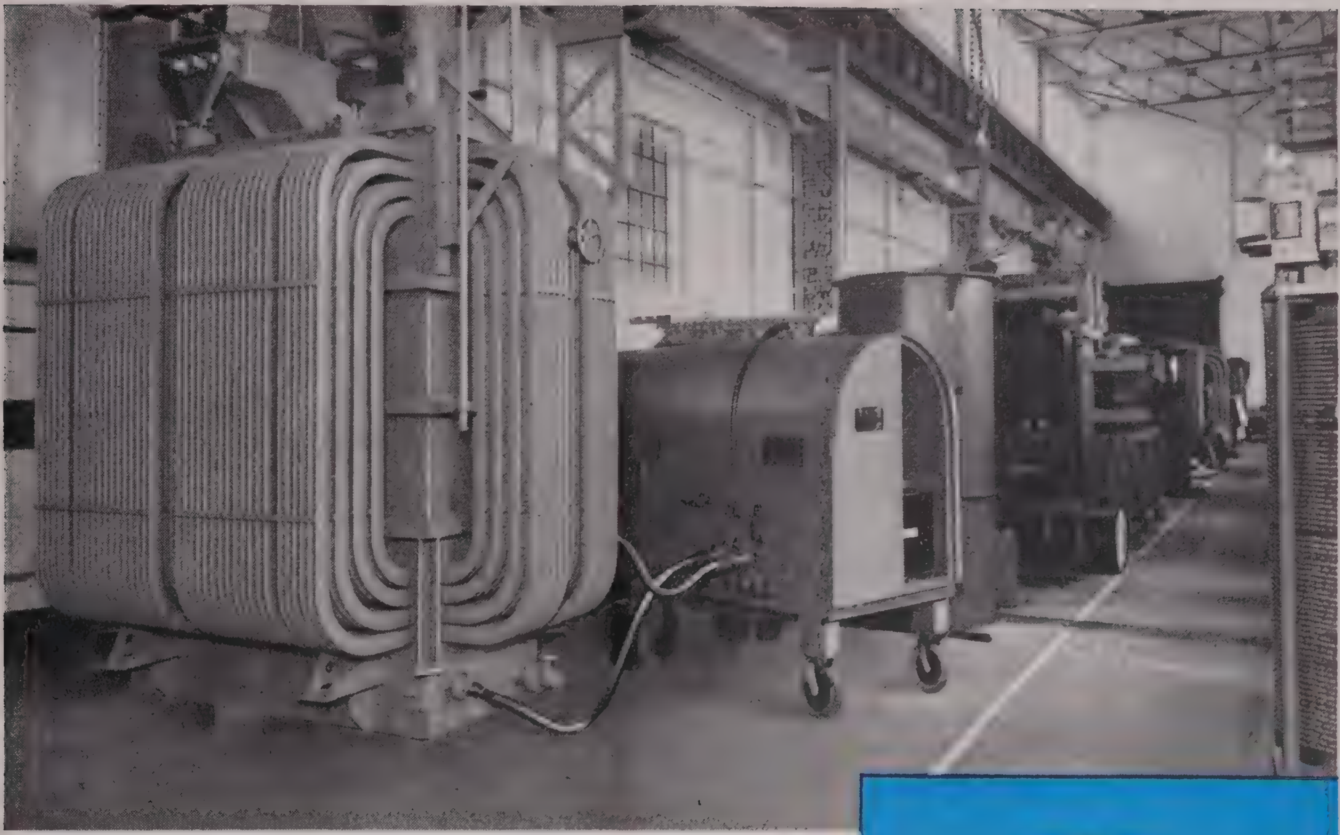

*Photograph by courtesy of Bryce Electric Construction Co. Ltd., Hackbridge, Surrey.*

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*for insulating oil*

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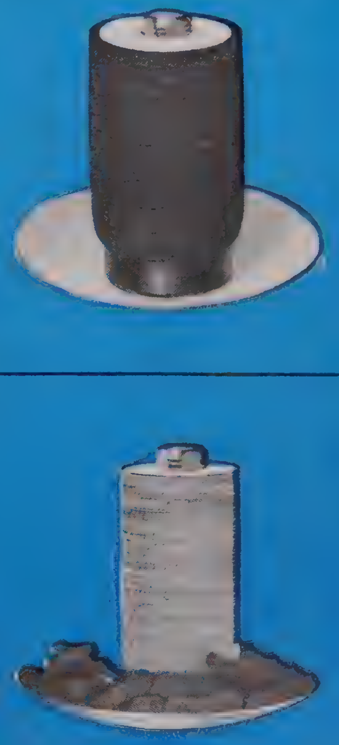

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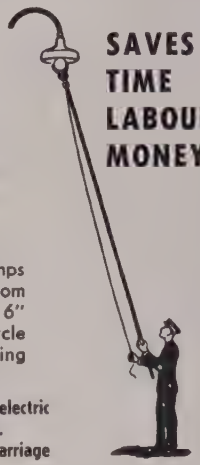
for 200 to 500 watt lamps E.S. Caps at 20′ 0″ from ground. 7′ 0″ closed. 16′ 6″ extended. Weight 5½ lb. Cycle clips and Extension Tubing supplied.



**SAVES TIME LABOUR MONEY**

Used by the leading corporation and electric light companies throughout the world. Prices and particulars on request. Carriage Paid in Great Britain.

**J. F. APPELBE & CO. LTD.**
GREAT UNION STREET, HULL
*Telephone 33522, 31212 and 8725. Telegraphic Address "Appelbeco, Hull"*

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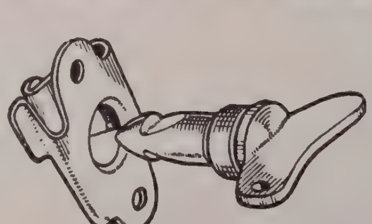
# ODDIE FASTENERS



The Fastener with endless applications. Simple, Positive, Self-locking. Made in a variety of types and sizes.

*Special Fasteners to suit customers' requirements*

WIDELY USED IN THE ELECTRICAL AND RADIO INDUSTRY

Department "E.R."

**ODDIE, BRADBURY & CULL LTD.**
**SOUTHAMPTON**
*Telephone 55883* *Cables: "Fasteners, Southampton"*

**established success**

**Plessey UK-AN**

Registered Trade Mark

**connectors**

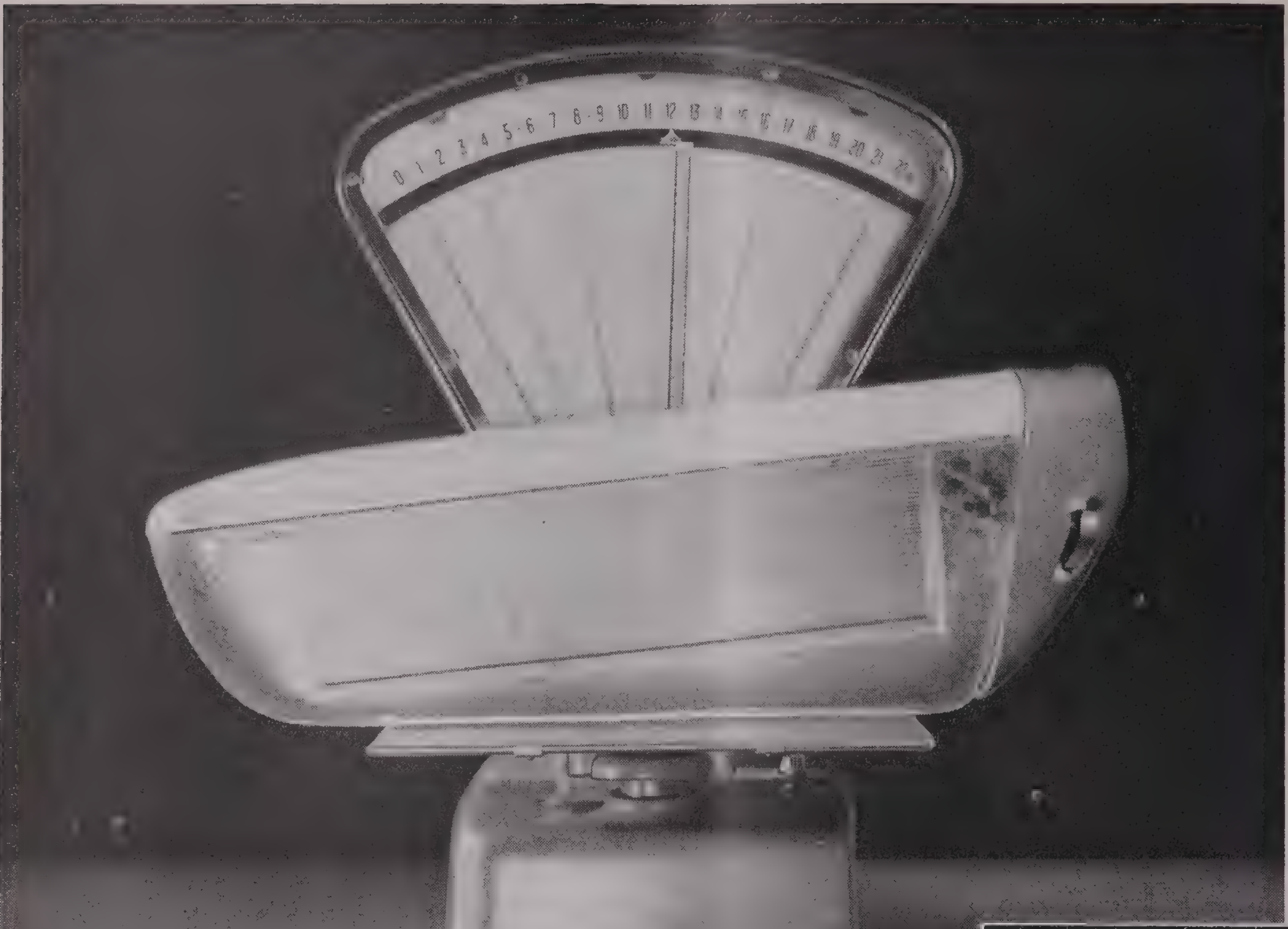
- 2 kV r.m.s. all contacts
- −65°C to + 190°C working
- 30 p.s.i. pressure seal
- 180 contact arrangements
- Climatic proof
- Waterproof
- Shock proof
- Vibration proof
- Crimped connections
- Fireproof and hermetically sealed types
- Interchangeable with A.N. or M.S. connectors

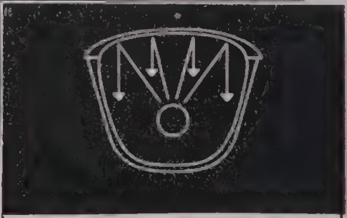
This has prompted the publication of a fully descriptive booklet, No 109, which sets out in detail the characteristics of these outstanding connectors. Write for a copy now—on Company-headed paper, please.

Wiring and Connectors Division
**THE PLESSEY COMPANY LIMITED**
Cheney Manor · Swindon · Wilts · Swindon 6251

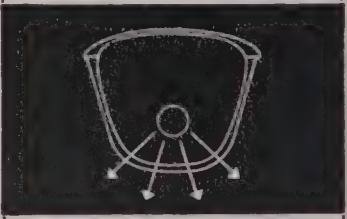
Overseas Sales Organisation:
Plessey International Limited · Ilford · Essex
Ilford 3040

CW21

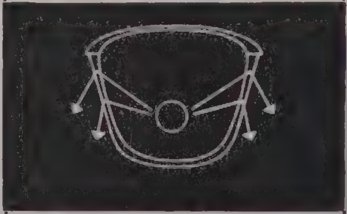




*Reflection from Opal 'Perspex' canopy — over 80%.*



*Transmission through base of clear 'Perspex' bowl — 90%.*



*Refraction by machined 'Perspex' refractor plates designed to give most efficient light distribution.*

# 'Perspex' gives light with lightness

THIS Revo street-lighting lantern weighs only 12 lbs, yet it is over two feet long. It is designed for use with 140-watt sodium lamps and both the bowl and the canopy are made from 'Perspex' acrylic sheet.

Clear 'Perspex' is used for the bowl, slightly patterned to obscure the fittings inside. On each side, areas have been left unpatterned and refractor plates cemented to them. The plates are machined from 'Perspex' and designed to give the most efficient light distribution.

The efficiency of the lantern is completed by its canopy, which is made from a dense grade of Opal 'Perspex' and reflects more than eighty per cent of the light falling on it. This high reflectivity, together with the general optical efficiency of 'Perspex', is maintained throughout a very long life—ensuring the trouble free service over many years which is so essential in street lighting fittings.

Acrylic materials are unique in combining very light weight, optical efficiency and an almost complete immunity to weather. 'Perspex' acrylic sheet and 'Diakon' acrylic polymer offer these properties to the lighting fitting designer in a form that is both good looking and easy to work.

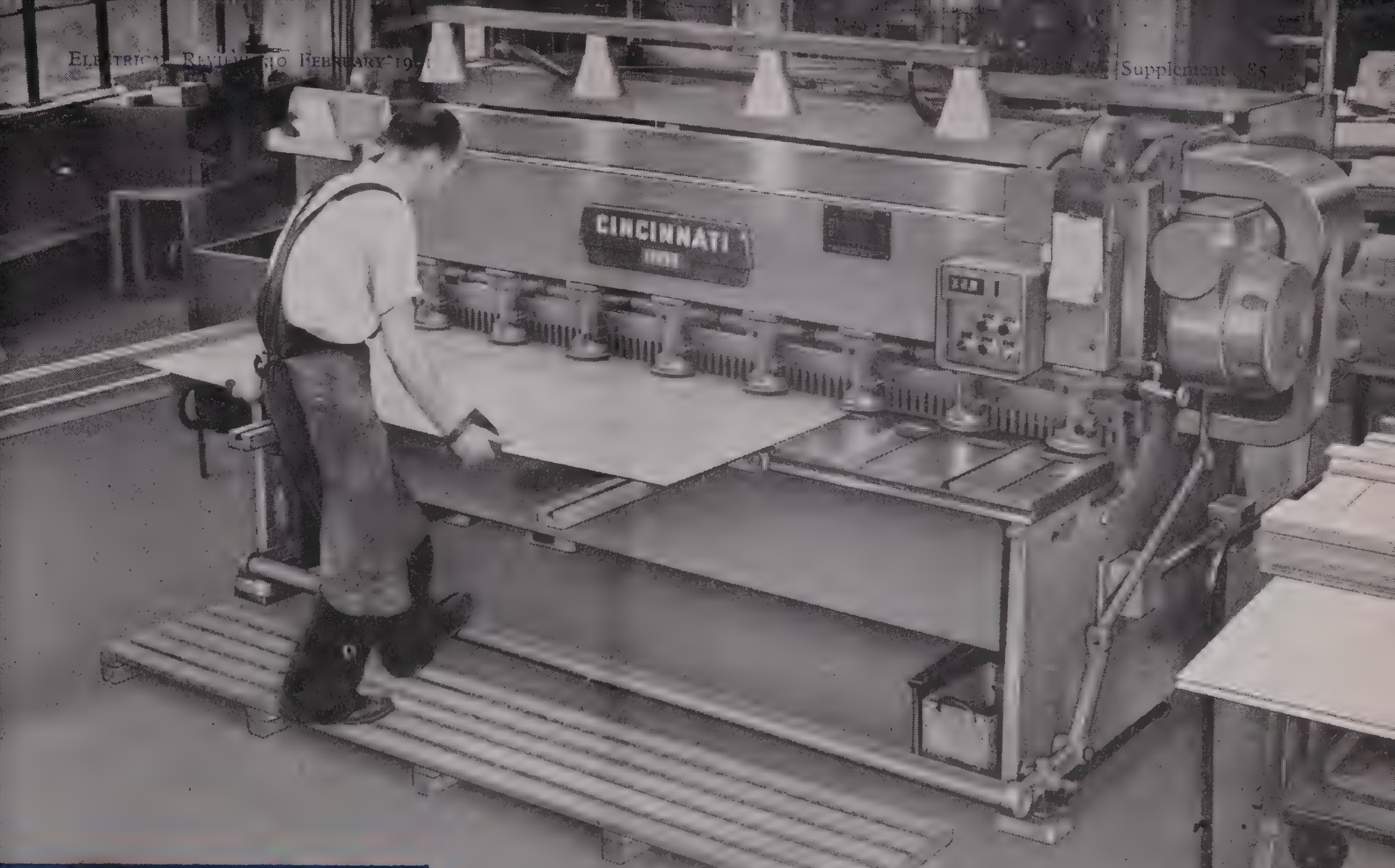
*'Perspex' is the registered trade mark for the acrylic sheet manufactured by I.C.I.*

'PERSPEX'

ICI

IMPERIAL CHEMICAL INDUSTRIES LIMITED · LONDON · S.W.1

FP76



# Setting time cut from 75% to "virtually nil"

**says Mr. Sam Craig, Works Manager of the Belmos Company Limited, Blantyre**

Our group motor control boards are built up from standard cubicle units which are produced in a wide range of widths and heights to suit customer requirements. That means a lot of short runs and frequent changes of setting. On two guillotine shears, 75% of production time used to be spent on back-gauge setting. Now we have one Cincinnati machine with power-operated back-gauge and the spare operator available for other duties. The operator sets the gauge by pressbutton from the front of the machine and starts shearing. Setting time is virtually nil, and one Cincinnati Shear now does the work of two others.

*A wholly-owned subsidiary of The Cincinnati Shaper Co., Cincinnati, Ohio, U.S.A.*

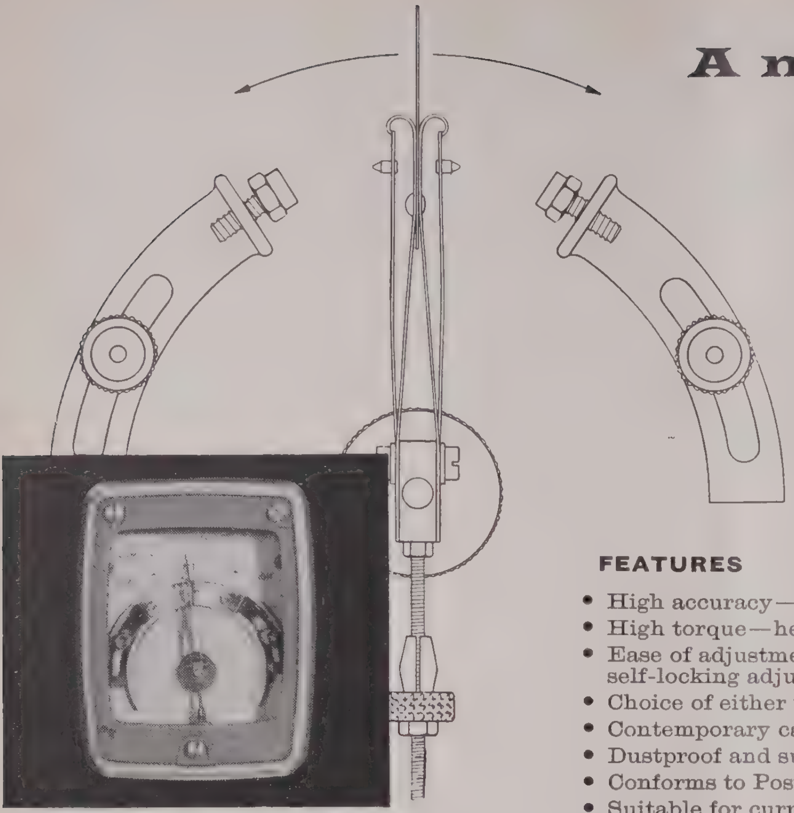
CINCINNATI

***Many companies in all parts of the world are cutting production time, improving accuracy and gaining more flexible capacity by installing Cincinnati Guillotine Shears. You can find out more about them by writing for a catalogue.***

# CINCINNATI

## GUILLOTINE SHEARS

**The CINCINNATI SHAPER CO LTD**
**PEEL PARK PLACE, EAST KILBRIDE, GLASGOW** *Phone: East Kilbride 20641*
*Distributors in England and Wales*
**E. H. JONES** (MACHINE TOOLS) **LTD**
*HOVE, LONDON, BIRMINGHAM, MANCHESTER & BRISTOL*



# A new and more sensitive Austinlite relay

**APPLICATIONS**

- ✻ Current regulator control.
- ✻ Voltage regulator control.
- ✻ Monitoring duties.
- ✻ Limiting duties.
- ✻ Equipment protection.

**FEATURES**

- High accuracy—to within ± 0.5%.
- High torque—hence positive contact pressure.
- Ease of adjustment with fine and coarse settings and self-locking adjustable contacts.
- Choice of either two or four adjustable contacts.
- Contemporary case design—projection or flush mounting.
- Dustproof and suitable for use in the tropics.
- Conforms to Post Office Specification P.T. 1025 B.
- Suitable for current or voltage sensing on either D.C. or A.C.

*Austinlite* **ELECTRICAL EQUIPMENT CUSTOM-BUILT BY STONE-CHANCE LTD.**
(MAKERS OF SUMO PUMPS AND STONE-CHANCE LIGHTHOUSES) CRAWLEY, SUSSEX.

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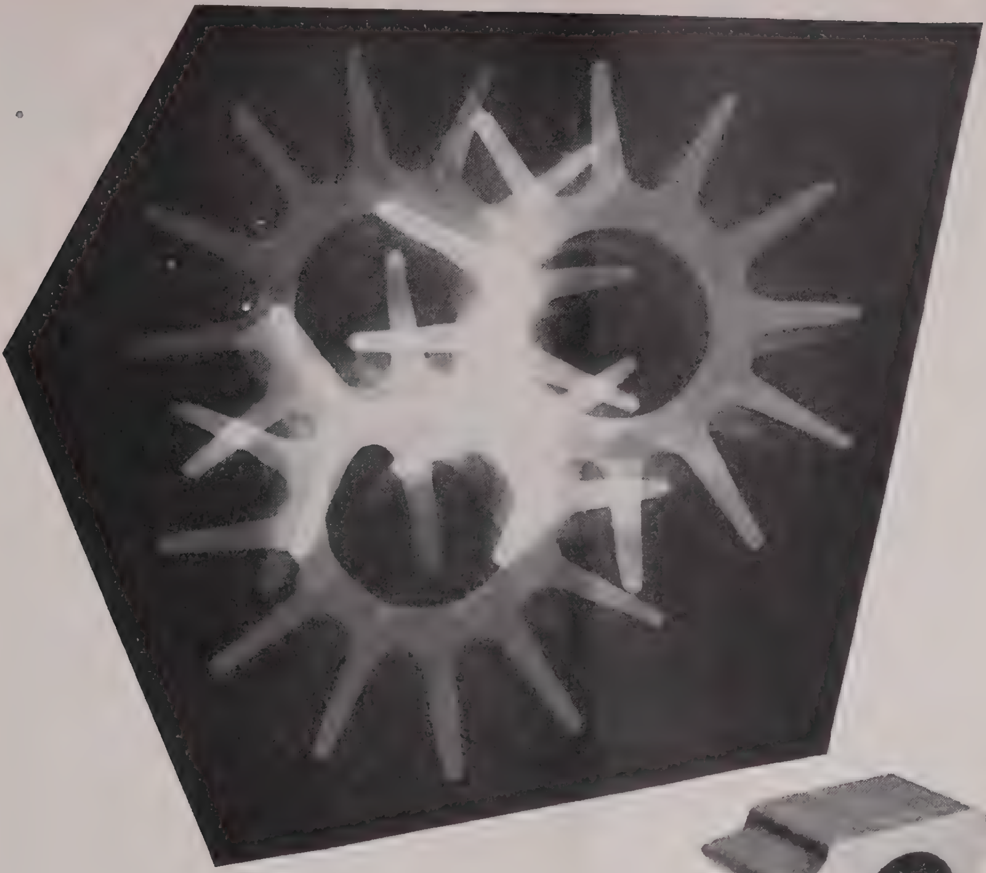
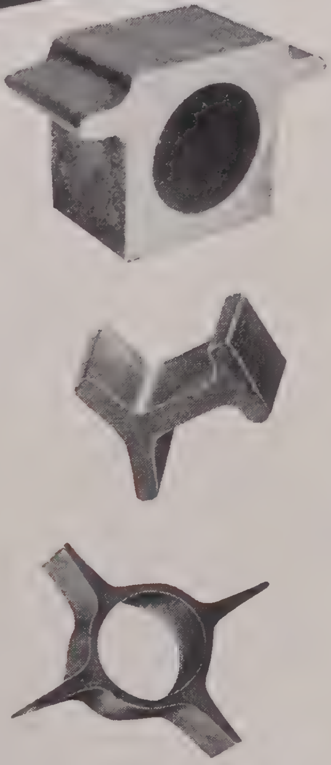
# ...this mark means quality and value

Made by James Neill & Co. (Sheffield) Ltd. and obtainable from all tool distributors

UH31





**INCREASE IN OUTPUT WITH A REDUCTION IN COSTS!**

Yes ! Extrusions can reduce or eliminate expensive machining, welding or fabrication time, and are closer to the finished shape. Also new advances in design are possible by using extruded Steel Sections.

Available in all grades from Mild to Complex Alloy Steels. Full details on request.

For details of Alloy and Special Steels,
and Super Hiperm, contact:
Low Moor Alloy Steelworks Ltd.

**LOW MOOR**
FINE STEELS LIMITED

LOW MOOR, BRADFORD
Telephone: 77331 (9 lines)

THE BRILLIANT RANGE OF SIEMENS & HALSKE GEARED MINIATURE D.C. MOTORS. Siemens & Halske high efficiency miniature D.C. motors are available in three sizes, the largest being approximately 1¼″ x ¾″ including gearbox. Motors are available with working voltages up to 4V D.C., but they will in fact turn from a signal as low as 50 mV. Torques are impressive—up to 270 cm.gms.—and an electro-mechanical efficiency of the order of 70%. The working temperature range is —35°C to +60°C.

B&R RELAYS LIMITED

**B. & R. RELAYS LTD., TEMPLE FIELDS, HARLOW, ESSEX**

Telephone: Harlow 25231/4 *Member of the Gas Purification Group*

# CONTROL

# and E.D.C.C.

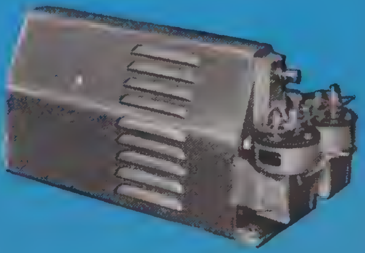
The Control Gear Division of Electro Dynamic Construction Company at Bridgwater Somerset specialises on both standard and special-purpose control equipment. A few examples of the considerable range and variety of equipment are illustrated here. A very large proportion of this range is manufactured to specification. Special attention is given to the development of prototype equipment for future batch production.

**E.D.C.C. are manufacturers of:**

- Dynamometers
- Rotary Convertors
- Flame-proof marine motors
- Frequency changers
- Induction Regulators
- Single and polyphase alternators.
- HF alternators
- Voltage stabilisers
- Rotary transformers
- Battery traction motors
- D.C. generators
- Magnetic couplings
- Control gear, etc.

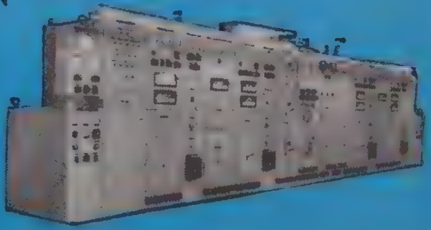
Standard marine hand-operated Face-plate starter.

Standard marine automatic starter.

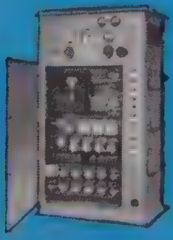


Carbon stack controller for battery-operated vehicles.

Control desk for multiple M.G. set.



G.P.O. Power Supply Control and Distribution Board.



Control Panel (Marine Pattern) for Automatic mains failure standby equipment.

Automatic Transistorised Controller of Electrical Machinery Voltage or Speed.

Discuss your requirements with us at the A.S.E.E. Exhibition, Stand No. L.14, Ground Floor

## ELECTRO-DYNAMIC

CONSTRUCTION COMPANY LIMITED

ST. MARY CRAY ORPINGTON KENT TELEPHONE: ORPINGTON 27551 TELEGRAMS: ELEDAMIC ST. MARY CRAY

*Control Gear Division: Bridgwater Somerset. Telephone: Bridgwater 2882 Glasgow Office: 40 Houldsworth St. C3 Telephone Central 2620*

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HED

'BH' SPOT WELDING AND BRAZING HEAD

Designed for use on miniature and small assembly work in the manufacture of radio valves, these spot welding machines are finding an ever-widening field of application in many industries where reliable welding methods are required.

They are capable of meeting with absolute reliability the most exacting and stringent welding requirements. This is made possible by the patented and unique mechanical constructions of the electrode system, which, in addition to being frictionless and permitting extremely rapid follow-up speeds, also possesses the features of being non-wearing and not subject to "play" or backlash.

*Write for illustrated leaflet*

OTHER H.E.D. PRODUCTS: *Precision Welding Equipment* ● *Welding Controls* ● *Saturable Reactors* ● *High Speed Contactors* ● *Transformers* ● *Coil Winding* ● *Magnetizing Equipment* ● *Air-conditioned Welding and Assembly Benches*

**HIRST ELECTRONIC LTD.** GATWICK ROAD · CRAWLEY · SUSSEX · Crawley 25721-2-3

*it's much faster*

*with*

MASON MASTER

with the tip you can't BURN OUT

Mason Master drills are made to be used at a much wider range of speeds than any other masonry drills, they can be used in a hand drill or in the fastest electric drill. The tip which is electronically brazed with copper will not come out, even if subjected to RED HEAT.

*Insist on MASON MASTER*
*you know you can rely on them*

For larger holes for the insertion of pipes—conduit etc. *WITHOUT MESS* get our literature on the range of MASON MASTER S.F. drills up to 1½" diameter, for any depth of hole. Also CONCRETE MASTER for holes up to 6" diameter.

*IT'S MORE ECONOMICAL TO USE MASON MASTER - & CLEANER TOO*

MASON MASTER
SAFE-D-SPEEDER
4 TO 1 REDUCTION GEAR

You can use a ¼" portable electric drill for masonry drills up to 1" diameter without overloading, with a SAFE-D-SPEEDER.

Fits directly into the chuck of any electric drill. Fitted with its own QUALITY chuck up to ½" capacity. Also available with forward and reverse action for screwdriving, drilling and tapping, etc.

*See your local Tool dealer or Ironmonger, or send direct for literature on these tools.*

**JOHN M. PERKINS & SMITH LTD.,** BRAUNSTON, RUGBY
PHONE: BRAUNSTON 351-2

**DISTRIBUTION PROBLEM?**

a HENLEY Straight Through Joint Box for P.I.L.C. and armoured Cable up to 11,000 volts.

Just think of the equipment with the AEI name behind it!

Distribution pillars and panels—Underground disconnecting boxes, branch boxes, service boxes and straight-through joints—Indoor and outdoor terminal boxes—Indoor and outdoor service fuses—H.T. and super-tension joints and sealing ends—Overhead service accessories—Rising mains systems—House service fuses and consumers' control units—Jointing materials and accessories of every description.

**AEI CABLE DIVISION**

**Associated Electrical Industries Limited**
**DISTRIBUTION EQUIPMENT SALES DEPARTMENT**
145 Charing Cross Road - London WC2 - *Tel: GERrard 9797*

For the proper care and protection of your products
use
Reed
PAPER GROUP
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The combination of the latest advances in pharmacology with nursing skill exemplifies the protection of the vulnerable by those trained in guardianship. No less effective are the brains and skills behind R.C.C. producing the specially designed cases which give that *extra* care and protection to almost any product.

**REED CORRUGATED CASES LIMITED**

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**Reedac** cases

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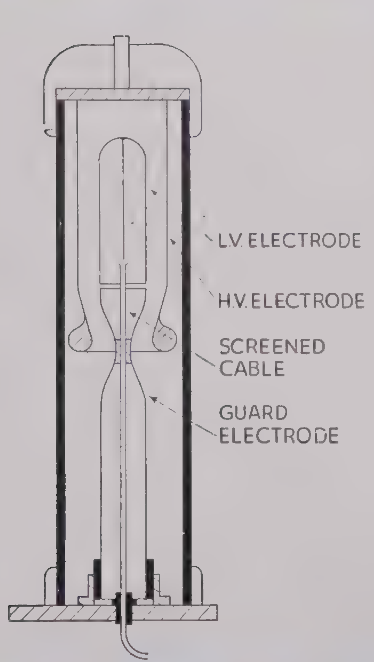
# STANDARD CAPACITORS

The Bushing Co. Ltd. manufactures a range of compressed gas capacitors intended for use as comparison standards for the measurement of capacitance and dielectric loss factor. The capacitors are constant in value and virtually loss-free.

The gaseous insulant is dry, oxygen-free nitrogen at a pressure of 10 atmospheres and freedom from losses and invariance of capacity is ensured by the design and screening of the electrodes.



*The sizes available are 50kV, 150kV, 200kV, 300kV and 500kV both 50pF and 100pF capacitors are available in each size.*

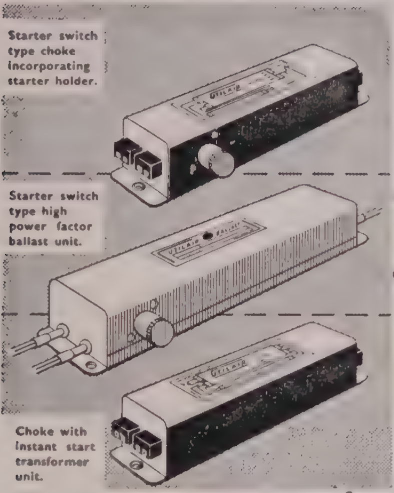
**THE BUSHING COMPANY LTD.**
**HEBBURN-ON-TYNE, ENGLAND**

Telephone: HEBBURN 83-2241
Grams: "BUSHING HEBBURN"

THE BUSHING CO. LTD.
TEXOLEX
HEBBURN-ON-TYNE

UTILAIR

BRITAIN'S BEST FLUORESCENT LIGHTING FITTINGS & CONTROL GEAR

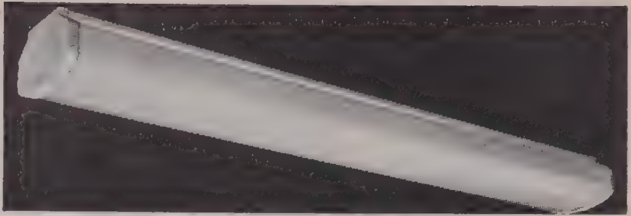


Starter switch type choke incorporating starter holder.

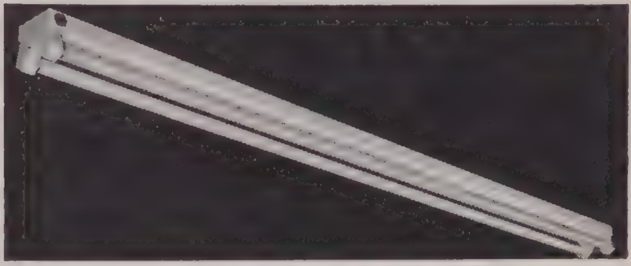
Starter switch type high power factor ballast unit.

Choke with instant start transformer unit.

Britain's best range of Fluorescent Fittings selected for efficient lighting by famous concerns all over the world



**Model EP.802** Suspended or ceiling fitting with opal fluted diffusing cover



**Model D.2125** Twin 8ft. 125 watt batten fitting

**Model VP.802** Industrial vapour-proof totally enclosed fitting

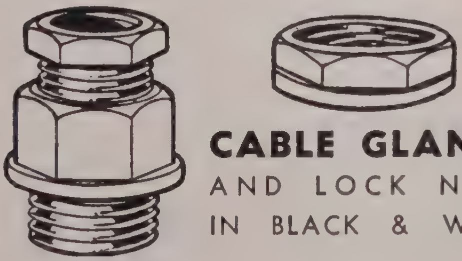
**UTILITIES** (LONDON) **LTD.**

*Manufacturing Electrical Engineers*

TUNSTALL ROAD · BRIXTON
LONDON · S·W·9

*Telephone: Brixton 6811-4* *Telegrams: Utilon, London, S.W.9*

NYLON!!



CABLE GLANDS
AND LOCK NUTS
IN BLACK & WHITE

AND

12-WAY FLEXIBLE TERMINAL STRIPS

5 – 30 AMPS

Also: Terminal Strips in P.V.C. and Bakelite, Connectors in Nylon and Porcelain, Cable Straps, Porcelain E.S. Lampholders, Neon Indicator Lights, "Lox-all" Lamp Locks, "Columbus" Time Lag Switches.

*ASK FOR LEAFLETS*

**ELKAY ELECTRICAL MFG. CO. LTD.**

**42 WOBURN PLACE, LONDON, W.C.1.** LANgham 1975

*Sole Agents:*

**SHIMWELL, ALEXANDER & CO. LTD.**

**THE MARINE ELECTRICAL PEOPLE**

**Voigt and Haeffner Packet Switches**

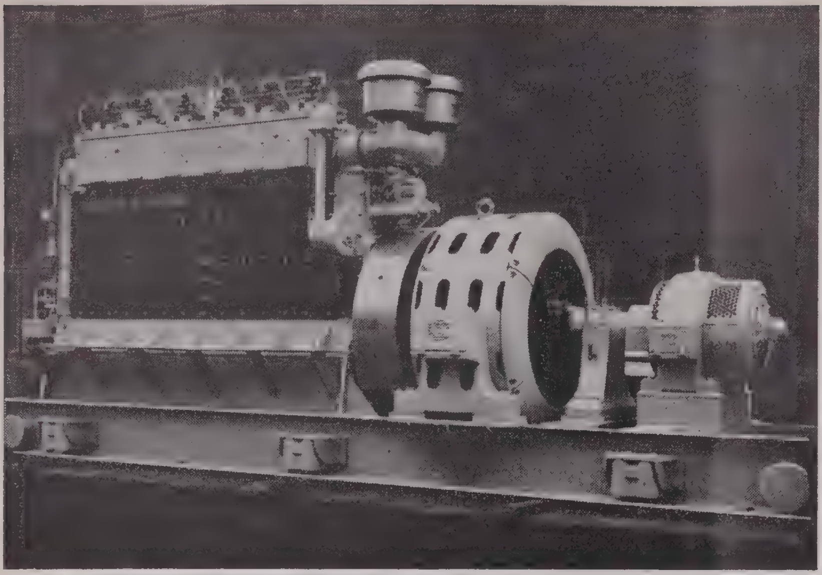
*Original Manufacturers*

10 to 600 Amps up to 600 Volts AC/DC in full range of switching sequences. All contacts silver plated. MELAMINE non-track Insulation. Also full range of Contactors, Circuit breakers, etc.

**20 BEVIS MARKS - LONDON - E.C.3**

Tel: AVEnue 6111/7 Telegrams: Shimalec, Fen, London

*SA5*



Lister Blackstone EVDF6 Dual Fuel six cylinder engine. 270 HP. 600 RPM.

SOMEBODY'S POWER PROBLEMS ARE NEARLY OVER......

This Lister Blackstone Dual Fuel Engine and Generator is on its way to site where it will not only provide the electrical power required economically, but the heat from the jacket water and exhaust gases will be fed to a Heat Exchanger from which the hot water will be used for process purposes etc. without additional fuel cost. May we send you the latest Lister Blackstone catalogue featuring diesel and dual fuel engines from 1½ to 1600 H.P.?

**LISTER BLACKSTONE**

LB

**BLACKSTONE & CO. LTD.**

**A Member of the Lister Group of Companies. DURSLEY, GLOUCESTERSHIRE.** *Phone: 2378 Telex: 4361*
London Office: Imperial House, Kingsway, W.C.2. Phone: TEMple Bar 9681

*There's money* *in* **SLOTMETERS!**

They not only SAVE money but MAKE money, are easily installed and provide an additional income in hotels, boarding houses, caravans, flats, etc. Fixed or variable price settings. A.C. or D.C. 200/250 volts. 2½ to 50 amps. Quarterly credit meters also available. Prices from 15/-. Billiards and television meters with choice of 1d., 6d., 1/- or 2/- slot and any time setting. From £4 each.

Time switches from 55/- each.

EVERY METER FULLY GUARANTEED FOR TWO YEARS.

All goods despatched via express delivery at no extra charge. Prices include packing, carriage and padlocks for slot-meters.

Our satisfied customers include owners of hotels, boarding houses, flats, garages caravan sites, etc. We also supply electrical contractors and wholesalers. Trade enquiries are particularly invited.

**I GUARANTEE** that all our factory rebuilt instruments are guaranteed for two years from date of despatch from our works During that time we undertake to repair or replace, at our option, any defective instrument returned to us carriage paid and having our original seals intact.

James S. Graham

James S. Graham at your service

**FREE** ILLUSTRATED BROCHURE

SPECIAL OFFER!
● Self-starting synchronous clock type motors 200/250v. 50c., from 3/6 each.

*PERSONAL CALLERS INVITED AND WELCOME*

**JAMES S. GRAHAM & CO., LTD. (Dept. 35)**
**73 Acre Road, Kingston-on-Thames, Surrey**
Telephone: KINgston 0075 *Open all day Saturday*

**FIRST AID**

Pioneers in Industrial First Aid well over half-a-century ago, before legislation for this was introduced, we have a wealth of experience and knowledge available to you when considering the provision of First Aid.

On January 1st 1960, revised First Aid regulations (S.I. 1959 No. 906) became operative, affecting most factories.

Ensure that you are complying with the latest regulations by consulting us for all your First Aid requirements.

No. A136W.

Conforming to the requirements of S.I. 1959 No. 906 for factories in which the number of persons employed exceeds ten but does not exceed fifty.

A PRODUCT OF *Cuxson, Gerrard & Co. Ltd.* OLDBURY BIRMINGHAM

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**CLASSIFIED** advertisements are PREPAID at 4/- per line (approx. 6 words).

**DISPLAYED CLASSIFIED**:—53/- per single column inch.

Where an advertisement includes a Box Number there is an additional charge of 1/-.

**SERIES DISCOUNTS** for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

**SITUATIONS WANTED**:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

Remittances payable to "ELECTRICAL REVIEW."

**REPLIES TO BOX NUMBERS** should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. If an applicant for a situation appearing under a Box Number does not wish his reply to be forwarded to a particular firm or individual, instructions to this effect should be addressed to the Advertisement Supervisor, ELECTRICAL REVIEW. The name of an advertiser using a Box Number cannot be disclosed.

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## OFFICIAL NOTICES, TENDERS, ETC.

### CARSHALTON URBAN DISTRICT COUNCIL

**Supply and Erection of Street Lighting Columns and Equipment: Stage V (Part)**

TENDERS are invited for the supply and erection of 28 Concrete Lighting Columns with equipment.

26 15′ columns for tungsten lighting.

2 25′ columns for 400-w. mercury lighting.

Tender forms and specification may be obtained from the Engineer and Surveyor, Stone Court, The Grove, Carshalton.

Tenders enclosed in the envelope provided are to be returned to the Chairman of the Council not later than 12 noon on WEDNESDAY, 1st MARCH, 1961.

The Council do not bind themselves to accept the lowest or any tender.

C. H. DURRANT,
Clerk of the Council.

District Council Offices,
The Grove,
Carshalton, Surrey. 7626

### URBAN DISTRICT COUNCIL OF BRAINTREE AND BOCKING

**Installation of Electric Wiring in the Institute**

TENDERS are invited for the above installation at the Institute, Braintree. Only tenders of contractors listed in the Roll of Approved Electrical Installation Contractors will be considered.

Specification and schedules can be obtained from the Engineer and Surveyor, Town Hall, Braintree, on payment of a deposit of £2 2s., to be refunded on receipt of a bona fide tender.

Tenders in a plain sealed envelope endorsed "The Institute" must be received by the undersigned not later than noon on Friday, 3rd March, 1961.

The estimated value of the work is £1,500-£2,000.

The Council do not bind themselves to accept the lowest or any tender.

W. BALSON,
Clerk of the Council.
7607

### COUNTY BOROUGH OF DEWSBURY

**Street Lighting Department**

TENDERS are invited for the supply of:—

Class A and B Concrete Columns.
140-watt and 200-watt Sodium Lanterns.
250-watt and 400-watt M.V. Colour Corrected Lanterns.
Tungsten, Sodium and M.V. Lamps.
Swan-neck Brackets and Spigots.
Control Gear.
Timeswitches.

Form of tender, etc., can be obtained from C. H. Midson, M.B.E., Lighting Engineer, 15-19, Victoria Road, Springfield, Dewsbury, Yorkshire, ONLY ON RECEIPT OF A FOOLSCAP STAMPED ADDRESSED ENVELOPE.

Tenders, enclosed in a PLAIN SEALED ENVELOPE and endorsed "Tender for Street Lighting Equipment," must be sent to me by Tuesday, 28th February, 1961.

A. NORMAN JAMES,
Town Clerk.

Town Hall,
Dewsbury, Yorkshire.
1st February, 1961. 7667

### BOROUGH OF KEIGHLEY

**Group "A" Street Lighting**

TENDERS are invited for the supply and erection (complete in one contract) of 133 Prestressed Concrete Columns and Arms and all equipment to Group "A" Lighting Standard (mounting height 25′). The contract also includes the taking down of 80 25′ high steel poles.

116 on Trunk Road A.65.

17 on Mill Hey and Station Rd., Haworth.

All lamps are 400-watt mercury vapour, which shall be carried in a lantern complete with glass bowl.

The form of tender, specification and bill of quantities (one for each portion of the works) may be obtained from the Borough Engineer, College Street, Keighley, where the plans and conditions of contract may be inspected during normal office hours.

Sealed tenders, on official forms, shall be delivered in plain envelopes endorsed "Tender for Group 'A' Lighting," to the office of the Town Clerk, Town Hall, Keighley, not later than 10 a.m. on Monday, 6th March, 1961.

The lowest tenders will not necessarily be accepted.

H. W. SMITH,
Town Clerk.

Town Hall,
Keighley. 7668

## SITUATIONS VACANT

*(See "Replies to Box Numbers" above)*

### CITY OF LEICESTER

**New Sewage Disposal Works, Wanlip**

**Appointment of Electrical Inspector**

APPLICATIONS are invited from persons of suitable experience for the temporary appointment of ELECTRICAL INSPECTOR on the site of the new Sewage Works now under construction at Wanlip, for which the Consulting Engineers are Messrs. J. D. & D. M. Watson. The job will entail the supervision of installations and the taking of measurements under the general direction of the Resident Engineer on a scheme comprising a diesel-electric generating station (3,000 kVA at 415 volts), underground cabling at 3,300 and 415 volts, switchgear, transformers, control gear, automatic equipment and electrically driven pumping and purification plant. Knowledge of mechanical installation work an advantage. Minimum qualifications City and Guilds Electrical Installation Work Course "C" Certificate or equivalent and five years' responsible experience of work of this nature.

The appointment is expected to be for two years' duration, but there would be an opportunity for the successful candidate to be considered for a permanent position on the termination of this appointment.

The salary will be £17 per week with customary overtime as worked in Civil Engineering and will be within the Scheme of Conditions of Service for the Miscellaneous Classes of Officers and the Local Government Superannuation Acts.

APPLICATIONS stating age, experience and the names of two referees to the undersigned not later than 25th February, 1961.

JOHN L. BECKETT, M.I.C.E.,
City Surveyor.

Town Hall, Leicester. 7643

Advertisements are accepted up to **first post on Monday** of the week of issue

If blocks, bold type or ruled borders are required then on **Friday** prior to week of issue

All communications to be addressed to:
Classified Advertisement Department,
ELECTRICAL REVIEW
Dorset House, Stamford Street
London, S.E.1

**Original testimonials should not be sent with applications for employment**

### SOUTH OF SCOTLAND ELECTRICITY BOARD

**Hunterston Nuclear Generating Station**

APPLICATIONS are invited for the undernoted superannuable appointments:—

(a) STATION CHEMIST
(Ref. G4/61).

The successful applicant will supervise the conventional and radiochemical station laboratories and be responsible for the testing and treatment of waters, gases and oils, radioassay of effluents and plant arisings and measurement of activity levels in district survey samples. Candidates should have had experience in a modern generating station and possess a University Degree or equivalent qualification. The successful applicant will be expected to undergo special training with the U.K.A.E.A.

Salary N.J.B. Class M, Grade 6, £1,650/£1,830 per annum.

(b) ASSISTANT STATION CHEMIST
(Ref. G5/61).

The successful applicant will be responsible to the Station Chemist for the work of the district survey laboratory, measuring the levels of total activity and of specific isotopes in district survey samples. He may also be expected to participate in routine station chemical analyses. Candidates should preferably have had some experience of low-level activity measurements and background counting techniques, and possess a Higher National Certificate or equivalent qualification.

Salary N.J.B. Class M, Grade 9, £1,350/£1,500 per annum.

Forms of application may be obtained from the Secretary, South of Scotland Electricity Board, Inverlair Avenue, Glasgow, S.4, and returned, quoting appropriate reference, not later than 24th February, 1961. 7637

### NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments which are subject to the conditions of the National Joint Board.

**Wear Sub-Area**

DISTRICT ENGINEER, HESLEDON.

Applicants should be suitably qualified engineers and must have had a sound practical training and considerable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground distribution networks, substation plant and auxiliary equipment.

Salary Schedule A, Class G, Grade 2, £1,535/£1,720 p.a.

**York Sub-Area**

THIRD ASSISTANT ENGINEER,
Operation and Maintenance Section,
SUB-AREA HEADQUARTERS, YORK.

Applicants should preferably have had experience of operation and maintenance duties in E.H.V., H.V. and L.V. networks supplying urban and rural areas.

Salary Schedule A, Class H, Grade 10, £965/£1,090 p.a.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. 7653

***Situations Vacant*** *(continued)*

### CENTRAL ELECTRICITY GENERATING BOARD

**East Midlands Division**

STATION SHIFT CONTROL ENGINEER, LEICESTER POWER STATION (Vacancy No. 15/61).

Applications are invited for the position of STATION SHIFT CONTROL ENGINEER at Leicester Power Station, Rawdykes Road, Leicester.

Candidates should be experienced in control room operation. A Higher National Certificate would be an advantage.

Salary will be in accordance with Class G, Grade 10 (£890-£1,015 per annum) of the National Joint Board Agreement, plus shift allowance.

Closing date for receipt of applications, 17th February, 1961.

GENERAL ASSISTANT ENGINEER, DERBY POWER STATION (Vacancy No. 17/61).

Applications are invited for the position of GENERAL ASSISTANT ENGINEER at Derby Power Station, Full Street, Derby.

Candidates should be suitably qualified young men who are interested in power station operation and/or maintenance as a career.

Facilities are available whereby experience can be obtained in all sections of a modern power station, and the prospects of advancement are real to those who are willing to take advantage of the opportunities.

The salary during the initial training period will depend upon qualifications and knowledge, and will be within the range £625-£805 per annum of the National Joint Board Agreement.

Closing date for receipt of applications, 17th February, 1961.

SHIFT CHARGE ENGINEER, BURTON-ON-TRENT POWER STATION (Vacancy No. 18/61).

Applications are invited for the position of SHIFT CHARGE ENGINEER at Burton-on-Trent Power Station, Wetmore Road, Burton-on-Trent, Staffs.

Sound technical training and practical experience in the control and operation of steam generating plant and main switchgear are required. Appropriate qualifications an advantage.

Salary will be in accordance with Class E, Grade 7 (£965 - £1,090 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 17th February, 1961.

FIRST ASSISTANT STATION CHEMIST, LEICESTER POWER STATION (Vacancy No. 19/61).

Applications are invited for the position of FIRST ASSISTANT STATION CHEMIST at Leicester Power Station, Rawdykes Road, Leicester.

Previous experience in a power station laboratory is essential and candidates should, at least, hold the H.N.C. in Chemistry. Candidates must be familiar with methods of sampling and analysis of coal, oil and water, and with the interpretation and application of analytical results.

Salary will be in accordance with Class G, Grade 9 (£965 - £1,090 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 17th February, 1961.

PLANNING ENGINEER, WILLINGTON "A" and "B" POWER STATION (Vacancy No. 20/61).

Applications are invited for the position of PLANNING ENGINEER at Willington "A" and "B" Power Station, P.O. Box 27, Derby.

Applicants should have held a position of responsibility in a modern power station and should have received a thorough practical and theoretical training.

Preference will be given to candidates who are corporate members of a recognised professional institution or who hold qualifications leading to such membership, and candidates should have a clear and objective approach to power station planning problems.

Salary will be in accordance with Class M, Grade 6 (£1,650-£1,830 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 17th February, 1961.

EFFICIENCY ENGINEER, WILLINGTON "A" and "B" POWER STATION (Vacancy No. 21/61).

Applications are invited for the position of EFFICIENCY ENGINEER at Willington "A" and "B" Power Station, P.O. Box 27, Derby.

Applicants should have held a position of responsibility in a modern power station and should have received a thorough practical and theoretical training.

Preference will be given to candidates who are corporate members of a recognised professional institution or who hold qualifications leading to such membership.

Salary will be in accordance with Class M, Grade 6 (£1,650-£1,830 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 17th February, 1961.

SECOND ASSISTANT STATION CHEMIST, LEICESTER POWER STATION (Vacancy No. 22/61).

Applications are invited for the position of SECOND ASSISTANT STATION CHEMIST at Leicester Power Station, Rawdykes Road, Leicester.

Experience of analyses of fuel, water and oils is desirable and educational standard up to Higher National Certificate would be an advantage.

Salary will be in accordance with Class G, Grade 11 (£825-£940 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 17th February, 1961.

GENERAL ASSISTANT ENGINEER (Chemist), CASTLE DONINGTON POWER STATION (Vacancy No. 23/61).

Applications are invited for the position of GENERAL ASSISTANT ENGINEER (Chemist) at Castle Donington Power Station, near Derby.

Candidates should possess the Ordinary National Certificate in Chemistry as a minimum qualification, and should have previous experience in the analysis and testing of coal, water and oil, preferably in a power station laboratory.

The salary will be within the range £625-£805 per annum of the National Joint Board Agreement.

Closing date for receipt of applications, 24th February, 1961.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Station Superintendent concerned, and should be returned to him by the date stated.

O. S. WOODS,
Divisional Controller.
7655

### RHODESIA AND NYASALAND

THE Federal Ministry of Education invites applications from men under 50 for the post of :—

**Lecturer or Assistant Lecturer in Electrical Engineering, The Polytechnic, Salisbury**

Previous teaching experience is not essential, but an enthusiasm for experimental investigation in the light current field is necessary.

Salary Scales :—

ASSISTANT LECTURER: £997 10s. × £52 10s. to £1,050 × £105 to £1,260 × £52 10s. to £1,785.

LECTURER: £1,522 10s. × £52 10s. to £1,890.

A Lecturer must hold a University Degree or equivalent and have had at least two years' relevant post-qualification experience in industry or teaching On the Assistant Lecturer scale up to six increments are allowed for experience; on the Lecturer scale up to four increments are allowed for industrial and/or teaching experience over and above that required as a qualification for entry.

Service is permanent and pensionable; pensions are generous and there is a widows' and children's pension scheme. The passages of the Lecturer or Assistant Lecturer appointed, his wife and dependent children under 18, are paid by the Federation.

Accommodation is not provided, but there is no difficulty in obtaining it privately in Salisbury. Facilities for the education of children are exceptionally good and the climate is very agreeable.

Full information on the scope of the work, entry points into the salary scale, terms of service, conditions of life, etc., may be obtained, together with application forms, from the Education Liaison Officer, Rhodesia House, 429, Strand, London, W.C.2.

Applications should be submitted not later than 6th March and the date of appointment will be settled by mutual agreement. 7627

### CENTRAL ELECTRICITY GENERATING BOARD

**South Eastern Division**

**Littlebrook Power Station**

SHIFT CHARGE ENGINEER (Vacancy No. 48/61).

The successful applicant would be expected to take charge of 480 MW of plant and should have had experience in a modern power station. Possession of H.N.C., together with operational experience of P.F. and oil firing would be an advantage.

Salary N.J.B. Class L, Grade 6, £1,748 10s. to £1,952, including London and shift allowances.

Applications giving age and details of experience, qualifications, etc., should be sent to the Station Superintendent, Littlebrook Power Station, near Dartford, Kent, to arrive by 21st February, 1961. 7642

## Esso FUEL OIL TECHNICAL SERVICE

THE ESSO PETROLEUM COMPANY LTD., has a vacancy for a university graduate to work on industrial applications of fuel oil.

The position will be in the Fuel Oil Technical Services Group of the Company's Technical Sales Department at Feltham, Middlesex, which is responsible for laboratory quality control of products, development of new product outlets and for investigation of and assistance with customers' technical problems.

Applicants should have some industrial experience together with some scientific training but previous experience of fuel oil burning is not essential. Age preferably not more than 35. The position is based on Feltham, Middlesex.

Salary will be commensurate with experience and qualifications. There is a Contributory Pension Scheme and other benefits.

Please apply in writing, giving full details and quoting reference 308/ER to

**The Manager, Recruitment and Training**
**Esso Petroleum Company Limited**
**16, Charles II Street, London, S.W.1**

7641

**United Kingdom Atomic Energy Authority**

## THE CULHAM LABORATORY

for Research into Controlled Thermonuclear Reactions

# EXPERIENCED SERVICES ENGINEERS

are required for the New Laboratory now being built at Culham, near Abingdon, Berkshire.

The Services Engineers will be responsible to the Site Works Engineer for operating and maintaining site services at the Laboratory. They will be required to assist in the establishment of necessary facilities, including workshops and staff, and develop these to meet the needs of a growing site for minor works and maintenance.

There are two posts :—

The first requires experience of the installation, operation and maintenance of HV and MV distribution networks and extensive power and lighting installations.

The second requires experience of the installation, operation and maintenance of site mechanical services, boiler house, ventilation equipment, water treatment plant, compressed air and gas supplies, etc.

You are invited to apply if you are a corporate member of a senior engineering institution or have an equivalent qualification and have considerable supervisory experience.

STARTING SALARY (according to experience) on a scale £1,560 to £2,090 p.a.

Housing and contributory superannuation schemes.

Send a postcard for further details and application form to:—

THE PERSONNEL OFFICER (CAP/40/08/48)
Culham Laboratory, A.E.R.E., Harwell, Berks.

7593

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### POWER HOUSE ENGINEERS

required by **Air Ministry** for 2-year tour in Aden under contract; some family accommodation available for married men. Starting salary is according to age, qualifications and experience and ranges from £743 at age 22 to £909 at age 28 or over, rising to max. of £1,014. Tax free foreign service allowance in addition to salary varies according to marital status and whether or not official accommodation is occupied, viz.:—

Single :—
  Accommodated £200 p.a.
  Unaccommodated £455 p.a.
Married :—
  Accompanied and in official accommodation £755 p.a.
  Accompanied and in private accommodation £1,190 p.a. and excess rent.
  Unaccompanied and in private accommodation £815-£855 p.a.
  Unaccompanied and in official accommodation £560 p.a.

Kit allowance and free passage overseas, also free passages for family, when private or official accommodation arranged. Free medical and educational arrangements and good sports facilities. 5-day week with 18 days' paid annual leave. Paid sick leave within certain limits.

Candidates must have had indentured apprenticeship of not less than 3 years, served preferably with a manufacturer of diesel engines of 300-2,000 b.h.p. Also not less than 5 years' experience following apprenticeship, at least 2 years of which should have been in a power house containing diesel engine-driven alternators. Experience of parallel running of alternators and of planned maintenance of power house plant would be an advantage. Preference given to candidates holding O.N.C. (Mech.) or equivalent.

Applicants, who must be natural-born British subjects, should write stating age, qualifications and experience to Manager (PE.520), Ministry of Labour, Professional and Executive Register, Atlantic House, Farringdon St., London, E.C.4. Selection will be by interview in London and some expenses entailed will be reimbursed. 268

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### DEPUTY ENGINEER

required for Ghana by leading British merchant's house. To be fully qualified electrical engineer with commercial and practical experience overseas in a wide range of electrical equipment and to act as deputy to Ghana engineering manager. Preferably under 36 years of age. Commencing salary £1,500/£1,800 depending upon experience, plus commission, free partly-furnished accommodation, provident funds, etc. Full personal particulars and experience to—Box 7429.

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CJB

### ELECTRICAL CONTRACTS ENGINEER

required to act as Assistant to Electrical Contracts Manager.

Candidates should be up to the age of 27 and have served a recognised apprenticeship with a reputable electrical contractor followed by at least two years supervisory duties.

Preference will be given to candidates possessing qualifications to H.N.C. standard and experience of industrial and flame proof installations. Good salary and contributory pension scheme.

*Please write stating age, qualifications, experience and present salary to:*

**The Personnel Manager**
**CONSTRUCTORS JOHN BROWN LIMITED**
**C.J.B. House, Eastbourne Terrace**
**Paddington, London, W.2**

quoting Ref. No. K.7969

7613

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### ELECTRICAL ENGINEER

required by the United Kingdom Atomic Energy Authority, Production Group, Springfields Works, Salwick, Preston, Lancashire, to be responsible for electrical services and equipment associated with a wide range of chemical and industrial plant; inspection, acceptance and commissioning of new installations; and alterations and additions to existing plant.

Electrical equipment involved includes machine tools and welding and industrial heating installations, as well as equipment normally associated with chemical plant.

A recognised engineering apprenticeship and Corporate Membership of the Institution of Electrical Engineers, or a good degree, are essential. Experience in the type of work described is also required.

Salary £1,005 (at age 25) to £1,535.

Contributory superannuation. Housing assistance schemes.

Send postcard for application form, quoting reference SF87/J.7, to Works Secretary at above address.

Closing date: 28th February, 1961. 7620

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### THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION

APPLICATIONS are invited from qualified men within the age bracket 30/35 for the post of TECHNICAL ASSISTANT in the Switchgear Department at Ascot. Applicants should have :—

(a) A good educational background;
(b) Experience with switchgear and ancillary equipment;
(c) Administrative ability, personality and tact.

Some familiarity with the work of technical committees and the production of specifications would be an advantage.

A salary will be paid commensurate with qualifications and experience. There is a contributory staff superannuation scheme.

Applications should be addressed to the Secretary of the Association, 36, Kingsway, London, W.C.2. 7598

***Situations Vacant** (continued)*

### CITY OF SALISBURY ELECTRICITY DEPARTMENT

**Vacancy for Electrical Engineer (Protection)**

Salary Scale £1,025 × £102 10s. to £1,332 10s. × £76 17s. 6d. to £1,563 2s. 6d. × £51 5s. to £1,768 2s. 6d. per annum.

APPLICATIONS are invited for the fixed establishment post of ELECTRICAL ENGINEER (Protection) in the Salisbury Municipal Electricity Department on the scale £1,025 × £102 10s. to £1,332 10s. × £76 17s. 6d. to £1,563 2s. 6d. × £51 5s. to £1,768 2s. 6d. per annum. No allowances are payable.

Commencing salary is based on qualifications and experience. There is a barrier at £1,563 2s. 6d. per annum, above which no engineer can rise without being a Corporate Member of the British Institution of Electrical Engineers, and the maximum entry point into the grade is £1,614 7s. 6d. per annum.

Candidates must be Graduates of the British Institution of Electrical Engineers and/or hold an equivalent electrical engineering degree, and have had not less than five years' experience in general protection work.

Consideration, however, will be given to applicants who have not the above qualifications but who have had extensive practical experience. The salary scale applicable in such instance will be £1,568 5s. × £51 5s. to £1,722 per annum, commencing salary being at the minimum of the grade.

The successful applicant will work under the direction of the Test Engineer in the Consumers' Engineer's Section and his duties will comprise mainly :—

1. Design and commissioning of all types of protection schemes on generators, feeders, motors, transformers and other types of electrical equipment.
2. Determination of relay settings and the calculation of fault currents over the system. Supervision of staff engaged in the maintenance and repair of all relays and instruments associated with protection schemes.

The department has an extensive supervisory indication, control and telemetering scheme, and experience with similar equipment is desirable. Experience with electronic equipment would be considered an advantage.

The appointment will be subject to the City Council's Service and Leave Regulations. The successful candidate will be required to furnish to the Council a satisfactory medical certificate of fitness and to serve a probationary period of not less than six months, and if thereafter confirmed in his appointment, to join the Southern Rhodesia Local Authorities Joint Pension and Widows' and Orphans' Fund. He must also be able to comply with the requirements of the Federal Immigration Authorities.

Candidates must submit full particulars of their qualifications, training and experience, giving details of positions held and salaries received. Age, place of birth, nationality and marital state should be stated and copies of not more than three recent testimonials may be forwarded.

Particulars of the undertaking and a summary of conditions of service, pension and leave entitlements, etc., may be obtained from Messrs. Merz & McLellan, Carliol House, Newcastle upon Tyne, 1, quoting reference PN, to whom applications must be submitted on or before 17th February, 1961. 7522

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The following

**TECHNICAL SALES ENGINEERS**

are required by expanding firm of control gear manufacturers. Excellent salary, expenses, pension scheme and car provided. Knowledge of control gear desirable.

1. SENIOR SALES ENGINEER to take charge and develop the West Country and South Wales area. Past sales experience in this area essential.
2. SALES ENGINEER, age 23/30, to operate from London office under Branch Manager. Initial training period at works.
3. SALES ENGINEER, age 23/30, to operate in Newcastle area under Branch Manager. Initial training period at works.

Write, giving age, experience and salary required, to—Box 7621.

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## BRUSH

## RESEARCH DIVISION

## MECHANICAL AND ELECTRICAL ENGINEERS

The work of the Research Division is largely concerned with the products manufactured at Loughborough, which include rotating electrical machines, switchgear, control gear, power and distribution transformers, diesel electric locomotives, traction equipment and complete electrical power plants.

The Division is being expanded and moved into new laboratories. Digital and analogue computing facilities are available. Excellent opportunities exist for engineers with good Honours Degrees in the following fields :—

*HEAT TRANSFER — VIBRATION & STRESS ANALYSIS*

### Section Leaders

Engineers are required to take charge of the theoretical and experimental work of each of these Sections.

*TRACTION*

### Senior Research Engineers

Electrical problems associated with advanced types of electric and diesel electric locomotives, including solid state controls.

*ROTATING MACHINES DEVELOPMENT*

### Research Engineers

Experimental and theoretical analysis of new types of machines and associated equipment. An opportunity also exists for an engineer with H.N.C. qualifications.

The Company is situated on the outskirts of a small town, amid the pleasant Leicestershire countryside. Loughborough offers many fine schools of all grades and there are facilities for advanced studies at technical colleges and universities in the district. Successful candidates can look forward to an attractive salary and stable employment.

In appropriate cases, assistance can be given with housing and removal expenses.

Applications, WHICH WILL BE TREATED IN THE STRICTEST CONFIDENCE, should give brief details of experience, qualifications and the field of interest, and should be addressed to

**Mr. P. A. McCaig, quoting reference: PL.K9912**
**BRUSH ELECTRICAL ENGINEERING COMPANY LIMITED**
**LOUGHBOROUGH, LEICESTERSHIRE**
*A Member of the Hawker Siddeley Group*

7640

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## ASSISTANT ELECTRICAL MANAGER

A SOUTH Coast firm is considering the appointment of an ASSISTANT MANAGER for their Electrical Division.

The Division is responsible for ship electrical installations, design and manufacture of marine electrical and electronic equipment.

Applicants should be between 30 and 40 years of age and have had a thorough academic and practical training in the electrical field, and be in possession of a degree or appropriate professional qualifications, and in addition at least 5 years' experience in the electrical industry, preferably on marine work.

Good salary, conditions of employment, including pension scheme and prospects to the right man.

Write in the first instance to Box F291, c/o Streets, 110, Old Broad Street, London, E.C.2, giving particulars of past experience, age, salary required, etc.

4623

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### YORKSHIRE ELECTRICITY BOARD

**No. 4 (Leeds) Sub-Area**

THIRD ASSISTANT ENGINEER (Meters, Testing and Protection).

Applicants should have had a sound technical education and possess the H.N.C. in Electrical Engineering or equivalent qualifications.

A keen interest in technical problems is essential and previous experience of metering or protection will be an advantage.

Salary N.J.B. Class L, Grade 10 (Scale 10), £1,190/£1,325 per annum.

Applications, with the names of two referees, should be sent to the Manager, No. 4 (Leeds) Sub-Area, Yorkshire Electricity Board, Bramhope, Leeds, not later than 24th February, 1961.

**No. 5 (Wakefield) Sub-Area**

WAKEFIELD DISTRICT DEMONSTRATOR.

Applicants must have had experience in the demonstration of electrical appliances and be capable of advising consumers on any matter relating to the use of electricity in the home. They must have had experience in cooking practice and in general showroom duties. Preference will be given to applicants holding the certificate of a recognised domestic training college, the Housecraft Advisers' Diploma, the certificate of the Electrical Association for Women or an equivalent qualification.

Salary N.J.C. Grade 1, £600/£25/£700 per annum.

Applications, with the names of two referees, should be sent to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a, Denby Dale Road, Wakefield, not later than 24th February, 1961. 7659

## CENTRAL ELECTRICITY GENERATING BOARD

### South Western Division

GENERAL ASSISTANT ENGINEER (Drawing Office) (Vacancy No. ER/AV/20/61) required in the Electrical Department.

Superannuation scheme. Salary N.J.B. Class AX, Grade 14, Scale 4, £685-£870 per annum.

Applications are invited for a GENERAL ASSISTANT ENGINEER (Drawing Office) in the Electrical Department of the South Western Division for work associated with high-voltage transforming and switching stations. Applicants should be competent draughtsmen, should have a good general and technical education, and preferably have obtained, or be studying for, the Ordinary National Certificate in Electrical, Mechanical or Civil Engineering or an equivalent qualification.

ASSISTANT ENGINEER (Drawing Office) (Vacancy No. ER/AV/21/61) required at Hinkley Point Power Station.

Superannuation scheme. Salary N.J.B. Class O, Grade 16, Scale 7, £965-£1,090 per annum.

Applicants should be able to lay out schematic diagrams and general arrangements on electrical and mechanical plant and be able to detail drawings from sketches. The duties will also include some of a general nature which will offer scope for the widening of experience and future promotion. Applicants should preferably possess or be studying for a Higher National Certificate or equivalent qualifications.

Applications on form A.E.6/ACT, obtainable from the Divisional Secretary, 26, Oakfield Rd., Bristol, 8, should be completed and returned by Monday, 20th February, 1961.

Please quote appropriate vacancy number.

7665

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## SOUTH EASTERN ELECTRICITY BOARD

ASSISTANT DISTRICT ENGINEER, CENTRAL SUSSEX DISTRICT.

Salary £965 to £1,090 p.a. under N.J.B. Class F, Grade 8. Superannuable. Applicants should be suitably qualified and have had training and experience in the construction, operation and maintenance of underground and overhead distribution systems. The successful candidate may elect to have a service tenancy of a Board's flat.

Applications, quoting ER, and naming two referees, to District Manager, SEEBOARD, Electra House, Church Road, Haywards Heath, Sussex, by 22nd February, 1961.

ASSISTANT ENGINEER, MEDWAY DISTRICT.

Salary £965 to £1,090 p.a. under N.J.B. Class G, Grade 9 (Scale 7). Superannuable. Applicants, of good general education, should have had technical training to Higher National standard, with practical experience of general distribution work, and be capable of giving assistance on planning, construction or maintenance work.

Applications, quoting ER, and naming two referees, on forms from District Manager, SEEBOARD, Gardiner Street, Gillingham, Kent, by 22nd February, 1961.

ASSISTANT (WAYLEAVES), GUILDFORD DISTRICT.

Salary under N.J.C. Grade 2, £700 × £25 to £775 p.a. Superannuable. Applicants must have a good general education and be able to conduct negotiations with landowners, agents and public authorities for wayleaves for overhead lines and small substation sites. A knowledge of agriculture and of land values is desirable.

Applications, quoting ER, on forms from District Manager, SEEBOARD, Woodbridge Road, Guildford, Surrey, by 22nd February, 1961.

GEORGE WRAY,
Secretary. 7666

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## NORTH WESTERN ELECTRICITY BOARD

### Foreman (Overhead Lines), Stalybridge District

DUTIES will include the supervision of construction and maintenance of overhead lines, including the maintenance of steel tower 33-kV lines.

Salary £795 p.a., Grade 2, Schedule E. N.J.I.C. conditions.

Applications to Manager, No. 3 Sub-Area, North Western Electricity Board, Union Street, Oldham, by 18th February, 1961. 7610

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AEI

**Associated Electrical Industries Ltd.**
**Telecommunications Division**
**Woolwich, London, S.E.18**

## TELEPHONE EXCHANGE SALES ENGINEERS

Young Engineers required, preferably with light current experience in auto telephone switching or signalling equipment engineering, for work in sales offices.

A good general education required with H.N.C. or O.N.C. an advantage but lack of certificates will not bar applicants with compensating experience.

The vacancies offer permanent and pensionable posts with opportunities in an expanding organisation.

**Write to Staff Officer, Ref. 744/65/ER, A.E.I. Ltd., Woolwich, S.E.18.**

7603

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## PORT OF BRISTOL AUTHORITY

### An Assistant Engineer (Electrical)

APPLICATIONS are invited for the above post, to be graded A.P.T. IV, £1,140 to £1,310. The appointed candidate will work under the direction of the Chief Assistant Engineer (Electrical), whose duties include the installation, operation and maintenance of electrical equipment and the specification and control of new works. Electricity consumption approximately 17,000 kW and 75 million units per annum.

1. Candidates should have served an approved apprenticeship and be Graduate or Associate Members of the Institution of Electrical Engineers.

2. The successful candidate will have to pass a medical examination before appointment. The position is pensionable under the provisions of the Local Government Superannuation Acts.

3. Applicants must disclose whether they are related to a member or senior officer of the Bristol Corporation. Canvassing disqualifies.

4. Applications, stating age, qualifications, experience, etc., and enclosing copies of any supporting documents, must reach me by 10 a.m. on Friday, 3rd March, 1961.

T. L. MARTIN,
Engineer-in-Chief.

Port of Bristol Authority,
Avonmouth Docks, Bristol.
30th January, 1961. 7595

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## WANTED

SENIOR ELECTRICAL MOTOR DESIGNER

TOP EXECUTIVE SALARY

**HIGGS MOTORS**
**LIMITED**
**WITTON**
**BIRMINGHAM, 6**

*ARE ENTERING A NEW ERA*

**COME AND JOIN US**

7617

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## CITY OF SALISBURY ELECTRICITY DEPARTMENT

### Vacancy for Senior Electrical Engineer (Installation)

**Salary Scale £1,768 2s. 6d. × £51 5s. to £1,921 17s. 6d. per annum**

APPLICATIONS are invited for the fixed establishment post of SENIOR ELECTRICAL ENGINEER (Installation) in the Salisbury Municipal Electricity Department, on the above scale, commencing salary at the minimum of the grade. No cost-of-living or other allowances are payable.

Candidates must be Corporate Members of the British Institution of Electrical Engineers and/or hold an equivalent electrical engineering degree.

The post requires experience in the general application of electricity to industrial, commercial and domestic premises, the preparation of estimates for and planning of such installations, general knowledge of electricity regulations, and the commissioning and maintenance of electrical plant and installations. The successful candidate will serve in the Consumers' Engineer's Section as assistant to the Installation Engineer.

The appointment will be subject to the City Council's Service and Leave Regulations. The successful candidate will be required to furnish to the Council a satisfactory medical certificate of fitness and to serve a probationary period of not less than six months and, if thereafter confirmed in his appointment, to join the Southern Rhodesia Local Authorities' Joint Pension and Widows' and Orphans' Fund. He must also be able to comply with the requirements of the Federal Immigration Authorities.

Candidates must submit full particulars of their qualifications, training and experience, giving details of positions held and salaries received. Age, place of birth, nationality and marital status should be stated and copies of not more than three recent testimonials may be forwarded.

Particulars of the undertaking, and a summary of conditions of service, pension and leave entitlements, etc., may be obtained from Messrs. Merz & McLellan, Carliol House, Newcastle upon Tyne, 1, to whom applications must be submitted on or before 3rd March, 1961. 7634

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## SOUTH WALES SWITCHGEAR LIMITED

APPLICATIONS are invited for the post of TECHNICAL SALES REPRESENTATIVE. Switchgear training and qualifications to H.N.C. essential. Must hold current driving licence. Successful applicant will be based at Wilmslow.

Apply stating age, qualifications, experience and salary required to — The Home Sales Manager, South Wales Switchgear Ltd., Rex Buildings, Wilmslow, Cheshire, and mark the envelope "Confidential." 7574

***Situations Vacant** (continued)*

### EAST ANGLIAN REGIONAL HOSPITAL BOARD

**Regional Engineer's Department**

(1) ENGINEERING MAIN GRADE
(Mechanical).
(a) Corporate Members Inst. Mech. E. Salary £1,160-£1,600.
(b) Corporate Members Inst. H. and V. E. Salary £910-£1,400.
(c) Graduate Members Inst. Mech. E. Salary £910-£1,205.

(2) ENGINEERING MAIN GRADE
(Electrical).
Graduate Members Inst. E. E. Salary £910-£1,205.

Candidates appointed will be engaged on design of central heating and hot water systems, air conditioning equipment, etc., including design of steam boiler plant, laundry installations, etc., or electric lighting and power installations, radio and telephone installations and electronics in relation to hospital engineering projects. Experience in estimating and in preparation of specifications desirable.

Candidates appointed under 1 (a) or 1 (b) will be responsible for small design team for all aspects of mechanical engineering services in large hospital building projects.

Graduate Members of the Institutions of Mechanical and Electrical Engineers automatically proceed by increments to maximum of Grade (£1,600) upon being admitted to corporate membership.

(3) ENGINEERING DRAUGHTSMEN
(Mechanical and Electrical).
Grade I, salary £1,030-£1,250.
Grade II, salary £870-£1,010.
Grade III, salary £550-£850.

Candidates for I and II should preferably have H.N.C. or O.N.C. and be experienced in the design of engineering works and the preparation of tender drawings and specifications under supervision.

Candidates for III should have had minimum of 3 years' practical training including site or workshop experience. Knowledge of engineering drawing and estimating an advantage.

Applications stating age, qualifications, experience and details of present position with names of three referees to Secretary of Board, 117, Chesterton Road, Cambridge, by 3rd March, 1961. 7554

## ASSISTANT ENGINEER (ELECTRICAL)

required for the London Office of the CROWN AGENTS FOR OVERSEA GOVERNMENTS AND ADMINISTRATIONS for appointment normally to pensionable establishment on probation for 2 years. Commencing salary between £991 at age 25 and £1,318 at age 34 or over in scale rising to £1,490. Fully qualified officer at least 27 years of age may be eligible for special increase of £75 within maximum of scale after 2 years' service. Liberal leave. Five-day week.

Candidates, preferably between 25 and 35 years of age, should have Degree in Electrical Engineering or be Corporate or Graduate Members of the Institution of Electrical Engineers. They should have received their training with established electrical manufacturer, contractor or undertaking, and have had subsequent operating or design experience in either medium-size thermal power stations, transmission and distribution systems, or consumers' installations. Previous contract experience an advantage.

Duties include purchase of electrical plant and equipment, preparation of specifications for tenders, adjudication of tenders and technical correspondence with administrations.

Apply to CROWN AGENTS, 4, Millbank, London, S.W.1, for further particulars, stating age, name, brief details of qualifications and experience, and quoting reference M2A/51092/EF.

7661

BRITISH RAILWAYS

## RAILWAY ELECTRIFIED LINES OVERHEAD MAINTENANCE STAFF

VACANCIES exist on the Eastern Region Electrified Lines in the London Area. Applicants selected will be engaged as ASSISTANT OVERHEAD TRACTION LINEMEN at a base rate of £9 18s. per week. The average earnings for this grade amount to approximately £13 per week. Shift working is involved.

Courses of instruction are given and good opportunities exist for promotion to higher grades. Certain free and reduced rate rail travel facilities. Pension and sick pay schemes.

Apply giving full particulars of age, experience, etc., to

**Electric Traction Engineer (London Area)**
**BRITISH RAILWAYS, EASTERN REGION**
**Off Ley Street, Ilford, Essex**

7541

### EAST MIDLANDS ELECTRICITY BOARD

**Derby and Burton Sub-Area**

DEMONSTRATOR
(Vacancy No. 5/61).

Salary N.J.C. Grade 1, £600 × £25 to £700 per annum.

The successful candidate will be based at Derby, but will be required to operate throughout the Burton, Derby and Uttoxeter Districts.

Applicants must be over 21 years of age and should hold the E.A.W. Electrical Housecraft Certificate for Demonstrators and be experienced in general service centre duties and be capable of conducting demonstrations and advising consumers on the selection and use of electrical appliances, both at the service centre and on consumers' premises.

Ability to drive a motor vehicle will be an advantage.

Applications should be forwarded to the Manager, Derby and Burton Sub-Area, Electricity Offices, Irongate, Derby, in an envelope marked "Demonstrator," within fourteen days of the date of this advertisement.

**Area Board Headquarters**

SECOND ASSISTANT ENGINEER
(Planning and Design)
(Vacancy No. 19/61).

Salary N.J.B. Class BX, Grade 5, £1,375 to £1,720 per annum, or Grade 4, £1,465 to £1,830 per annum, depending on the experience and qualifications of the successful candidate.

The successful applicant will be required to assist in the preparation of schemes and reports for the extension and reinforcement of the Board's 33 kV system. Some knowledge of substation design is also desirable.

Applicants should be forwarded to the Chief Engineer, East Midlands Electricity Board, Mapperley Hall, Lucknow Avenue, Nottingham, within fourteen days of the date of this advertisement. 7652

### TELEPHONE TECHNICIANS: OVERSEAS/U.K. SERVICE

CABLE AND WIRELESS Limited require TELEPHONE TECHNICIANS for service at some overseas branches.

Duties include supervision of construction of external lines (overhead and underground) and installation of subscribers' station apparatus; planning of subscribers' networks, and ordering of materials.

Applicants, aged 20/30, must hold a minimum of 5 "O" level passes in G.C.E., including English, Mathematics and Physics, or appropriate C. and G. certificates. Preference given to those with knowledge of Strowger type exchanges and multi-channel carrier line systems. Full information, including pay and allowances, will be given at interview.

There is also an administrative vacancy for an ASSISTANT ENGINEER with similar background in the company's head office in London.

Write giving details of qualifications and experience to Staff Manager, Cable and Wireless Limited, Mercury House, Theobalds Road, London, W.C.1. 7471

### WIGAN AND DISTRICT MINING AND TECHNICAL COLLEGE

APPLICATIONS are invited for a post of SENIOR LECTURER in Electrical Engineering commencing 1st May, 1961 or by arrangement.

Candidates should preferably be honours graduates with industrial and/or teaching experience and possess Corporate Membership of the Institution of Electrical Engineers.

Salary in accordance with the Burnham Technical Scale for Senior Lecturers, viz. £1,550 × £50 to £1,750 per annum. Full allowance up to the maximum of the scale is given for appropriate experience.

Further particulars and application form will be sent by the undersigned. Last date for the receipt of applications, Friday, 3rd March, 1961.

E. C. SMITH,
Principal.

3rd February, 1961. 7654

AEI

**LAMP AND LIGHTING CO. LTD.**

## DESIGN ENGINEER

The Lighting Equipment Engineering Department is expanding its activities and requires an additional DESIGN ENGINEER to work on further development of the Company's range of lighting equipment.

Applicants should have a minimum qualification of H.N.C. in electrical or mechanical engineering. Two or more years on product design or development in this field of work is desirable.

Write in confidence for appointment, quoting brief details of career to date, to:—

**The Personnel Officer,**
**A.E.I. Lamp & Lighting Co. Ltd.,**
**Rotherwas Works,**
**Hereford.**

7592

### METER SERVICE ENGINEER

LEADING Meter Manufacturer seeks ENGINEER capable of servicing full range of domestic and industrial metering equipment. Good theoretical knowledge required. Works training would be provided.

Applications stating age, experience, qualifications and salary required to Sales Manager.—Box 7616.

## MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts :—

**Board Headquarters**

COMMERCIAL ASSISTANT
(Sales, Publicity and Service Section, Chief Commercial Officer's Dept.).

Applicants should have a wide knowledge of modern sales techniques and the ability to give instruction in such techniques on courses dealing with the selling of all types of electrical apparatus and involving the basic sales training of new entrants and the specialised training of existing staffs. The successful applicant will also be required to assist as directed with general duties associated with sales promotion and development, and the possession of suitable qualifications will be an advantage. The appointment will be made within the scales of the appropriate negotiating machinery at a salary within the range £1,105/£1,500 per annum according to qualifications and experience.

Apply by letter, within 14 days, stating age, experience, qualifications, present salary and position to the Secretary, Midlands Electricity Board, Mucklow Hill, Halesowen.

**Wolverhampton and District Sub-Area**

FOURTH ASSISTANT ENGINEER (Headquarters).

Duties will be of a general nature within the Technical and Planning Section. Salary according to experience and qualifications £965/£1,090 per annum (N.J.B. Grade L.13) or £1,040/£1,165 per annum (N.J.B. Grade L.12).

THIRD ASSISTANT DISTRICT ENGINEER (Lichfield).

Applicants should have had experience in the construction and maintenance of high and medium-voltage distribution systems. Technical qualifications desirable. Salary £825/£940 per annum (N.J.B. Grade E.9).

Apply by letter, within 14 days, stating age, experience, present position and salary to Mr. D. Holt, Sub-Area Manager, Midlands Electricity Board, 83, Darlington Street, Wolverhampton.

F. W. CATER,
Secretary. 7638

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## APC

VACANCIES exist for enthusiastic Engineers and Physicists in the Construction and Commissioning Department of the company.

ENGINEERS and PHYSICISTS are required as members of the Commissioning Team for the Nuclear Power Station at Trawsfynydd, North Wales, and for future projects. The work will initially be in London, but successful applicants will be transferred to North Wales at the time of the commissioning of the power station.

Applicants should be technically qualified and have some experience of either nuclear physics or the operation and commissioning of power station plant, but further training will be given as appropriate. A number of appointments are to be made at both Senior and Junior levels.

Vacancies also exist for JUNIOR ENGINEERS in the Department at Head Office, where the work is generally that of programming, progressing and liaising with site during the construction of major undertakings.

Applications giving full details of qualifications and experience should be sent to:

**The Personnel Manager (Ref. ER/166)**
**ATOMIC POWER CONSTRUCTIONS LTD.**
**28, Theobalds Road, London, W.C.1**
7594

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## SOUTHERN ELECTRICITY BOARD

**Field Engineer (Construction)**

Sub-Area Engineering Department of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class L, Grade 13 (£965-£1,099 per annum). N.J.B. conditions of service.

The duties of the post will be to carry out site supervision, installation and erection of plant, equipment and overhead lines, the laying of cables and other constructional work on all distribution systems up to and including 33 kV.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him, quoting Z.1312, not later than 20th February, 1961.

**Assistant Engineer (Local)**

Yeovil District of No. 4 (Bournemouth) Sub-Area, located at Shaftesbury. Salary N.J.B. Class F, Grade 10 (£825-£940 per annum). N.J.B. conditions of service.

Applicants should have had experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems. The possession of suitable technical qualifications would be an advantage. The successful candidate will be required to carry out standby duties if and when called upon to do so.

Applications on forms obtainable from the Sub-Area Secretary, 1, Priory Road, Bournemouth, and returned to him, quoting Z.1313, not later than 20th February, 1961.

**General Assistant Engineer**

Weymouth District of No. 4 (Bournemouth) Sub-Area. Salary N.J.B. Class F, Grade 11 (£765-£870 per annum). N.J.B. conditions of service.

Applicants should have had sound experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution mains and substations. The possession of suitable technical qualifications would be an advantage. The successful candidate will be required to carry out standby duties if and when called upon to do so.

Applications on forms obtainable from the Sub-Area Secretary, 1, Priory Road, Bournemouth, and returned to him, quoting Z.1311, not later than 20th February, 1961.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible. 7660

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## EASTERN ELECTRICITY BOARD

**Northmet Sub-Area**
(18/61.R)

FOURTH ASSISTANT ENGINEER
(Operation and Maintenance),
Sub-Area Engineer's Department
(Ref. 1013).

Applicants should be qualified and experienced in the maintenance of distribution plant on systems of 33 kV and below, and be capable of co-ordinating maintenance programmes, advising on methods and investigating faults.

The successful candidate will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Salary N.J.B. Class N, Grade 12 (£1,240-£1,375), inclusive of London allowance.

Apply by letter to the Manager, Eastern Electricity Board, Northmet Sub-Area, Northmet House, Southgate, London, N.14, by 20th February, 1961. 7650

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## SENIOR ESTIMATING ENGINEER

required for London office of national contractor, capable of preparing tenders and designing all types of commercial and industrial installations. Bonus scheme in operation in addition to salary.

Apply in writing, giving full details of qualifications, age, experience, etc., or telephone for an appointment.

**DUNCAN WATSON**
**(ELECTRICAL ENGINEERS) LTD.**
**60, Worship Street, London, E.C.2**
Telephone No. BIS. 4752
7534

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## NORTH WESTERN ELECTRICITY BOARD

**Assistant Secretary (Education)**

APPLICATIONS are invited for the post of ASSISTANT SECRETARY (Education). The duties of the successful applicant will include the administration of a comprehensive training policy for all types of employees, and the organisation of internal training courses.

Applicants should be graduates of a British university and should have had appropriate experience in industry.

The salary will be in accordance with Class D, Grade 4 of the N.J.M. & H.E.G. Committee Agreement, i.e., £2,170 × £75 to £2,320 × £60 to £2,380, and the successful candidate will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme if eligible.

Applications, on forms to be obtained from me at the North Western Electricity Board, Cheetwood Road, Manchester, 8, should be received by the Board not later than 27th February, 1961.

J. W. K. EVANS,
Secretary. 7636

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## SOUTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable positions :—

**THIRD ASSISTANT ENGINEER** (Substations) on the staff of the Area Engineer, Monmouthshire and Mid-Wales Area, at Cwmbran.

Preference will be given to engineers possessing the Higher National Certificate in Electrical Engineering.

Salary N.J.B. Scale 9, Class K, Grade 10 (£1,115-£1,245 per annum).

Applications stating age, present position, present salary, qualifications and experience should be addressed to D. G. Gwyn, B.Sc., A.M.I.E.E., Manager, Monmouthshire and Mid-Wales Area, Llywelyn Road, Cwmbran, Mon., to arrive not later than 25th February, 1961.

Please quote ref. 11/61/ER, endorsing envelope "Third Assistant Engineer."

**ASSISTANT ENGINEER** in the South Cardiganshire District (Cardigan) in the West Wales Area of the Board.

Preference will be given to engineers possessing the Higher National Certificate in Electrical Engineering.

Salary N.J.B. Scale 3, Class D, Grade 10 (£715-£805 per annum).

Applications stating age, present position, present salary, qualifications and experience should be addressed to W. E. Richardson, M.I.E.E., Manager, West Wales Area, South Beach Pavilion, Tenby, Pembs., to arrive not later than 25th February, 1961.

Please quote ref. 13/61/ER, endorsing envelope "Assistant Engineer."

R. G. WILLIAMS,
Secretary.

7639

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## SENIOR CONTRACTING ENGINEERS

required by national contractors. Wide experience of all types of electrical installations essential. Bonus scheme. Contributory pension scheme with life assurance.

Write under private cover stating age, experience and salary required to :—

**DUNCAN WATSON**
**(ELECTRICAL ENGINEERS)**
**LIMITED**
**Andrew House, 60, Worship Street**
**London, E.C.2** 7648

***Situations Vacant** (continued)*

### NORTH WESTERN ELECTRICITY BOARD

**District Commercial Engineer,**
**South-West District, Altrincham**

DUTIES will include the organisation and control of all commercial staff and functions of the District; supply of information, and advice to all classes of consumers on electricity utilisation, tariffs, and all matters concerning electricity services; organisation and supervision of contract wiring work and maintenance services on consumers' premises; control of service centres, demonstrations, exhibitions, etc.; organisation and supervision of consumer records.

Corporate Membership of the Institution of Electrical Engineers will be an advantage.

Salary scale £1,795-£1,950 p.a., Grade J.2. N.J.B. conditions.

Applications on forms to be obtained from the Manager (Staff Vacancy), No. 1 Sub-Area, North Western Electricity Board, Town Hall, Manchester, P.O. Box 493, and returned to him by 22nd February, 1961. 7635

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### GOVERNMENT OF WESTERN NIGERIA

VACANCY FOR

## SENIOR ELECTRICAL ENGINEER

APPLICATIONS are invited for the post of SENIOR ELECTRICAL ENGINEER.

Qualifications. Chartered membership of the Institution of Electrical Engineers, plus a minimum of five years' responsible experience.

Duties. Responsibility for the design of all electrical installations in public buildings or Regional Government property in Western Nigeria; for the specifying of plant and materials, their procurement, the organisation of labour and technical personnel; the preparation of and adjudication of tenders; the supervision of works and the accounting for expenditure in connection with these works.

Conditions of Appointment. On contract for two tours of 12-18 months each in the first instance on a salary of £2,748 per annum. In addition, gratuity is paid at the rate of £37 10s. for each completed three months' service. Free first class passages for officer and his family on first appointment and when proceeding on leave; free medical treatment for officer and his family. Accommodation is provided at low rentals.

Method of Application. Applications should be completed in triplicate on the prescribed form, obtainable from the Official Secretary (Recruitment Branch), Office of the Agent-General for Western Nigeria, 178/202, Great Portland Street, London, W.1, from whom further particulars may also be obtained. Closing date: 3rd March, 1961.

7597

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### LONDON ELECTRICITY BOARD

**Assistant Distribution Engineer**

APPLICATIONS are invited for the above position in the Board's Eastern District at 84, Romford Road, Stratford, London, E.15.

Applicants should have a sound technical education to the standard of the Higher National Certificate and possess practical experience of engineering work associated with the organisation of a District distribution department.

The post is graded under Schedule A of the National Joint Board Agreement as Class J, Grade 12, £940 per annum rising to £1,065 per annum, inclusive of London allowance.

Applications should be sent to the Manager at the above address, within 14 days of the publication date of this notice. Please quote ref. PER/V/3200/R. 7664

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### ENGLISH ELECTRIC STAFFORD

require a

## TECHNICAL WRITER

for their

### METER, RELAY AND INSTRUMENT DIVISION

APPLICANTS should be between 30 and 40 years of age, possess at least an Ordinary National Certificate (Electrical), and have had some experience in technical writing in connection with power systems.

Enquiries from men without direct experience but who have a suitable engineering background with the potential to be able to translate technical information into publicity material will also be considered.

The post is a permanent one and staff status includes a pension. Details of accommodation arrangements and removal assistance will be discussed at interview.

Please write giving full details to the Technical Staff Officer, Dept. G.P.S., English Electric House, Strand, London, W.C.2, quoting reference ER1292G.

7625

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### THREE NIGERIAN INSTRUCTORS

required by leading commercial and industrial group to instruct apprentices and others in modern well-equipped and expanding schools.

One vacancy requires candidate with at least Final City and Guilds Certificate in Electrical Engineering with post-certificate practical experience, capable of practical and theoretical instruction up to the Intermediate City and Guilds level in electrical engineering.

Two other vacancies require candidate with at least Full Technological Certificate of the City and Guilds in Workshop Practice or Plant Engineering, or equivalent qualification as marine engineer. Required to instruct apprentices on the syllabus of the Intermediate City and Guilds of London Institute on Workshop Practice.

These positions are of senior staff standing and although salary will be dependent on qualifications and experience it will not be less than £1,000 per annum. Contributory pension fund, free medical attention in Africa, furnished accommodation at nominal rental. Other terms of service explained at interview.

Reply giving age, qualifications and experience to—Box 9658.

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### CENTRAL ELECTRICITY GENERATING BOARD

**Principal Assistant**

required in the Commercial Department at Headquarters, London, S.E.1.

The duties will include the preparation of estimates of the cost of providing traction and other special supplies of electricity; of the value of supplies of electricity purchased and of the cost of providing steam supplies; the formulation of tariffs and preparation of heads of agreement for the foregoing sales and purchases and the investigation of the economic justification of schemes involving capital expenditure.

Candidates should have responsible experience on the commercial or economic aspects of electricity supply and should preferably possess an engineering degree or corporate membership of a senior engineering institution or equivalent qualifications.

Salary within the range £2,230-£2,440 p.a.

Applications, stating age, qualifications, experience, present position and salary, to the Appointments Officer, 24/30, Holborn, London, E.C.1, by 27th February. Envelopes should be marked "Confidential, Ref. ER/56." 7662

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### MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

**Appointment of Establishments Officer**

APPLICATIONS are invited for the appointment of ESTABLISHMENTS OFFICER in the department of the Secretary at this Board's Head Office.

Considerable experience in recruitment, control of establishments, industrial negotiation, joint consultation, application of wage agreements and personnel matters generally is essential. Practical experience of personnel administration within the electricity supply industry would be an advantage. Salary £2,595-£2,815 per annum in accordance with Grade B.8 (Scale 5) of the scheme of salaries of the National Joint Managerial and Higher Executive Grades Committee.

Appointment subject to medical examination. Pension scheme.

Applications should be forwarded to me at Electricity House, Love Lane, Liverpool, 3, by Friday, 24th February, 1961.

M. M. PARKER,
Secretary.

7656

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### CENTRAL ELECTRICITY GENERATING BOARD

**Senior Assistant Engineer**

required in the Commercial Department at Headquarters, London, S.E.1.

The duties will include assisting in the preparation of estimates of the cost of supply of electricity, of revenue and capital budgets and of long and short term trading forecasts; analyses of the costs of supply and detailed work in connection with bulk supply tariffs.

Candidates should have a good technical education and experience in the commercial or economic aspects of electricity supply. Preference will be given to those who possess an engineering degree or are members of a senior engineering institution.

Salary within the range £1,805-£2,295 p.a.

Applications, stating age, qualifications, experience, present position and salary, to the Appointments Officer, 24/30, Holborn, London, E.C.1, by 1st March. Envelopes should be marked, "Confidential, Ref. ER/57." 7663

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### MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

SECOND ASSISTANT ENGINEER (Protection) required at No. 1 Sub-Area Headquarters. Salary within range £1,535/£1,720 per annum (N.J.B. M/7).

Duties will include power system protection and the testing and commissioning of H.V. cables, switchgear, transformers and associated equipment up to 33 kV.

Applicants should have had a general experience in the electricity supply industry, and be technically qualified.

Appointment subject to medical examination. Pension scheme.

Application forms, obtainable from the Manager, No. 1 Sub-Area, 24, Hatton Garden, Liverpool, 3, should be returned not later than 27th February, 1961. 7657

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### CENTRAL ELECTRICITY GENERATING BOARD

**South Wales Division**

Vacancy No. 28/ER/61

APPLICATIONS invited for the superannuable N.J.B. appointment of ASSISTANT SHIFT CHARGE ENGINEER at LLYNFI POWER STATION, nr. Bridgend, Glam.

Salary Schedule A, Class G, Grade 9, Scale 7 (£965 to £1,090 per annum plus 10% shift enhancement).

Applicants should possess Higher National Certificate or equivalent qualifications and have had operating experience in a modern power station.

Special application forms obtainable from Divisional Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-Fedwen Road, Gabalfa, Cardiff, to be returned by 25th February, 1961. 7649

## NORTH WESTERN ELECTRICITY BOARD

### Senior Demonstrator

THE NORTH WESTERN ELECTRICITY BOARD require a SENIOR DEMONSTRATOR for their Wigan District covering an area of 74 square miles with 4 service centres.

Candidates should have a good knowledge of electrical appliances and be competent to give demonstrations and lectures in public halls, service centres and on consumers' premises on cooking, laundering and housecraft subjects. The successful person will be required to assist in general service centre duties, as required, during normal hours of business.

The possession of a recognised diploma in domestic science or the E.A.W. Certificate in Electrical Housecraft would be an advantage.

Salary £700/£775 p.a. Superannuation scheme; annual holidays up to a maximum of 3 weeks, 3 days.

Applications on forms to be obtained from the Manager, No. 2 Sub-Area, North Western Electricity Board, 2, St. George's Road, Bolton, and returned to him by 20th February, 1961.

7611

## ENGLISH ELECTRIC

### Application Engineers

PROFESSIONAL engineering appointments are available on a wide range of manufacturing and application engineering duties on all classes of electrical equipment.

Experience in manufacturing, power generation and supply or in the utilisation of electricity is the qualification sought, and professional engineers in any of these fields are invited to apply for consideration.

A number of vacancies also exist for trained engineers seeking an opportunity of acquiring further experience and scope in this class of work.

All appointments are pensionable after a qualifying period.

Apply stating age, experience and qualifications to Department G.P.S., English Electric House, Strand, London, W.C.2, quoting reference ER497G.

7624

## SOUTH WESTERN ELECTRICITY BOARD

### IBM Machine Room Supervisor

APPLICATIONS are invited from persons aged 25/40 for the appointment of MACHINE ROOM SUPERVISOR for a large IBM installation in Plymouth.

Salary within Grade 6 (£1,150 to £1,240 per annum) of the N.J.C. Agreement.

The person appointed will be responsible to the Principal Assistant (Machine Planning and Operation) for the day-to-day running of the machine installation, which includes 3,604 calculators and 10 421/441 accounting machines.

Applicants should have a sound theoretical and practical knowledge of punched card methods as applied to billing, payrolls, stores, costing and expenditure analysis, and must be capable of supervising a large staff.

Applications to be made on standard form AE.6/ACT, obtainable from the Accountant in Charge, Central Accounting Office, South Western Electricity Board, Beaumont Road, Plymouth. Closing date for completed applications is 25th February, 1961. 7605

## WIREMEN

VACANCIES exist for WIREMEN able to work from circuit diagrams, and preferably with some experience of automatic instrumentation.

Five-day week.

Please apply to Director, Research & Development Division, Baird & Tatlock (London) Ltd., 14/17, St. Cross Street, London, E.C.1. 7651

## TRANSFORMERS

A WELL-KNOWN company in the S.W. London Area requires INTERMEDIATE AND JUNIOR DRAUGHTSMEN with some experience on Power Transformers in range 10-30,000 kVA. Permanent positions carrying excellent salaries according to experience. Contributory pension and life assurance scheme in operation and canteen facilities provided. Evening and Saturday interviews can be arranged.

Write stating age, experience and education to—Box 7577.

## FAWCETT PRESTON & CO. LIMITED

**(A Member of the Metal Industries Group of Companies)**

require a SALES ENGINEER with experience of industrial and traction resistors and their application. Preference will be given to applicants holding H.N.C. (Elect.) or equivalent.

Applications stating experience, age and present salary, etc., to the

**Personnel Officer**
**Dock Road, Bromborough, Cheshire**

7502

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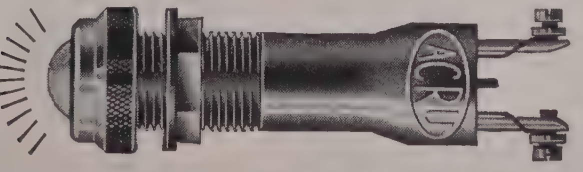

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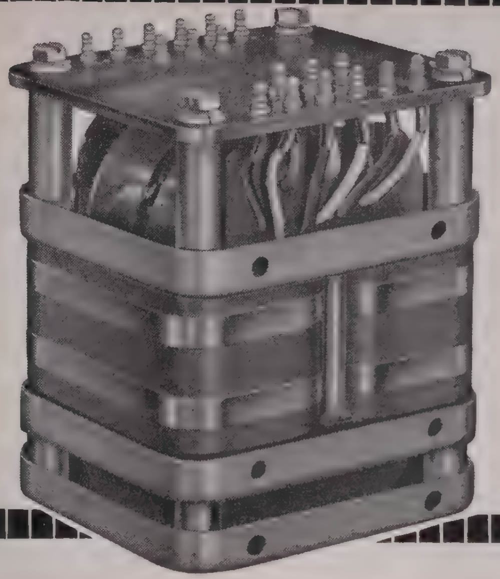

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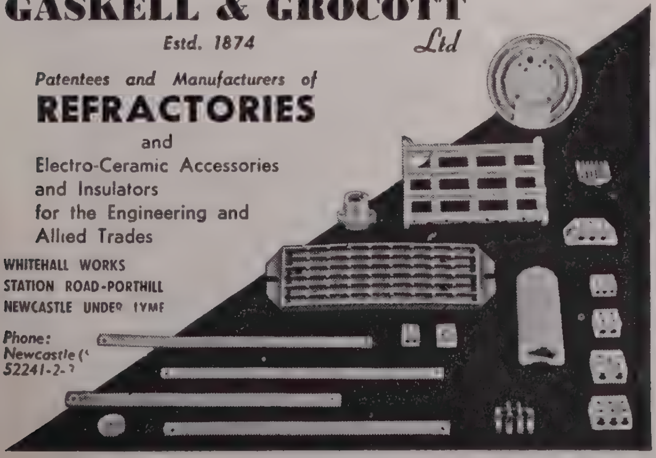

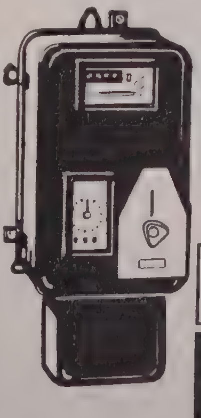

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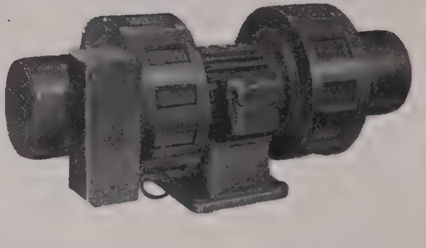

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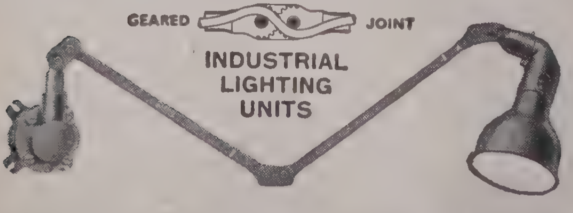

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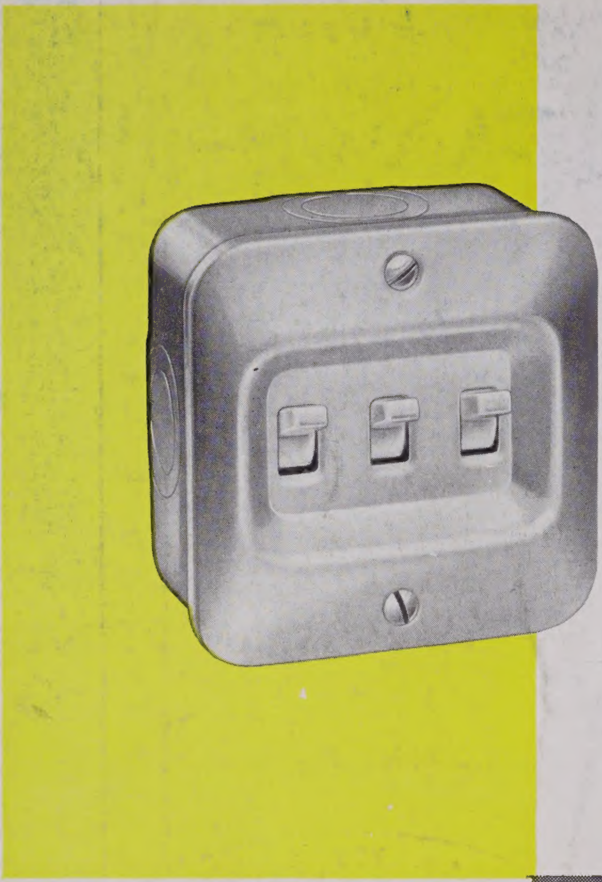

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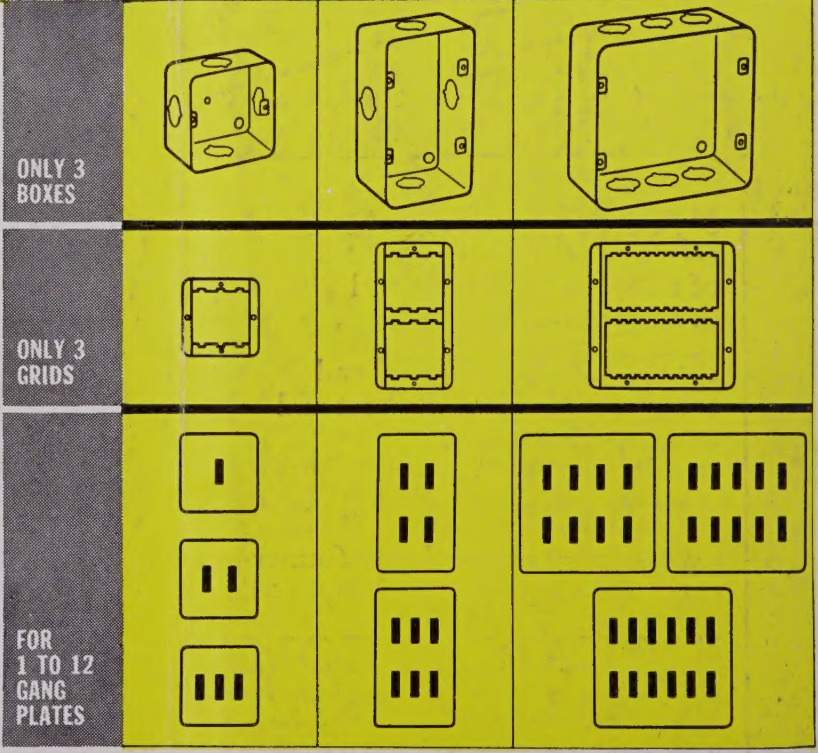

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